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August 23, 2010

Brandon Perkins, Task Monitor
United States Environmental Protection Agency
1200 Sixth Avenue, Mail Stop ECL-112
Seattle, Washington 98101

Re: Contract Number: EP-S7-06-02
Technical Direction Document Number: 10-05-0004
Final South Tacoma Channel Seep Sampling and Quality Assurance Plan

Dear Mr. Perkins:

Enclosed please find the Final South Tacoma Channel Seep Sampling and Quality Assurance Plan, which is located in Tacoma, Washington. If you have any questions regarding this submittal, please call me at (206) 624-9537.

Sincerely,
ECOLOGY AND ENVIRONMENT, INC.

Linda E. Costello

Linda Costello
START-3 Project Leader

cc: Jeff Fetters, Project Manager, E & E, Seattle, Washington

South Tacoma Channel Seep Final Sampling and Quality Assurance Plan

Tacoma, Washington

August 2010

Prepared for:
United States Environmental Protection Agency
1200 Sixth Avenue, Mail Stop ECL-112
Seattle, Washington 98101

Prepared by:

ECOLOGY AND ENVIRONMENT, INC.
720 Third Avenue, Suite 1700
Seattle, Washington 98104

SAMPLING AND QUALITY ASSURANCE PLAN FOR:

South Tacoma Channel Seep
Tacoma, Washington

Contract Number: EP-S7-06-02
Technical Direction Document Number: 10-05-0004

Prepared By:
Jeff Fetters, Project Manager
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720 Third Avenue, Suite 1700
Seattle, Washington 98104

Submitted To:
Brandon Perkins, Task Monitor
United States Environmental Protection Agency
1200 Sixth Avenue, Mail Stop ECL-112
Seattle, Washington 98101

Date: August 2010

Approvals

Title	Name	Signature	Date
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EPA Region 10 Quality Assurance Manager:	Gina Grepo-Grove		8/18/10
Region 10 RSCC	Jennifer Crawford		8/18/10
START-3 Project Leader:	Linda Costello	Linda E. Costello	7/28/10
START-3 Quality Assurance Officer:	Mark Woodke	Mark Woodke	7/28/10
START-3 Project Manager:	Jeff Fetters	Linda E. Costello for Jeff Fetters	7/28/10

SQAP and Final Report Distribution

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List of Abbreviations and Acronyms

Acronym	Definition
AC	Analytical Coordinator
BNSF	Burlington Northern Santa Fe (Railway Corporation)
CDA	City Directory Abstract
CERCLA	Comprehensive Emergency Response and Compensation Liability Act
CLP	Contract Laboratory Program
COC	Contaminant of Concern
DCE	trans-1,2-dichloroethene
DOH	(Washington State) Department of Health
DQI	Data Quality Indicators
DQO	Data Quality Objective
E & E	Ecology and Environment, Inc.
Ecology	Washington State Department of Ecology
EDR	Environmental Data Resources, Inc.
EPA	United States Environmental Protection Agency.
FFS	Focused Feasibility Study
FOWP	Field Operations Work Plan
FS	Feasibility Study
GIS	Geographic Information System
gpm	gallons per minute
GPS	Global Positioning System
IDW	Investigative Derived Waste
LCS	Laboratory Control Sample
MCL	maximum contaminant level
MEL	Manchester Environmental Laboratory
NAD	North American Datum
NPL	National Priorities List
OUs	Operable Units
PA	Preliminary Assessment
PCA	perchloric acid
PCB	polychlorinated biphenyl
PCE	tetrachloroethene
PE	Performance Evaluation
PL	Project Leader
PM	Project Manager
PO	Project Officer
ppb	parts per billion
ppm	parts per million

List of Abbreviations and Acronyms (cont.)

QA	Quality Assurance
QAM	Quality Assurance Manager
QAO	Quality Assurance Officer
QAPP	Site-Specific Quality Assurance Project Plan
QC	Quality Control
QMP	Quality Management Plan
RI	Remedial Investigation
ROD	Record of Decision
RPD	Relative Percent Difference
RSCC	Regional Sample Control Coordinator
SDMS	Site Date Management System
SI	Site Inspection
SIS	Sample Information System
SOP	Standard Operating Procedure
SOW	Statement of Work
SPAF	Sample Plan Alteration Form
SQAP	Sampling and Quality Assurance Plan
START	Superfund Technical Assessment and Response Team
SVOC	semivolatile organic compound
TA	Central Puget Sound Regional Transit Authority
Tacoma Seep	South Tacoma Channel Seep
TAL	Target Analyte List
TCE	trichloroethene
TDD	Technical Direction Document
TDL	Target Distance Limit
TM	Task Monitor
TPCHD	Tacoma Pierce County Health District
TPH	total petroleum hydrocarbons
VOCs	volatile organic compounds
WAC	Washington Administrative Code

1 Project Management

1.1 Project/Task Organization

This subsection outlines the individuals directly involved with the Site Inspection (SI) and their specific responsibilities. Communication lines are shown in the Project Organization Chart (Figure 1-1).

1.1.1 United States Environmental Protection Agency, Region 10, Task Monitor

The United States Environmental Protection Agency (EPA) Task Monitor (TM) is the overall coordinator of the project and decision maker. The TM reviews and approves the site-specific sampling and quality assurance plan (SQAP) and subsequent revisions in terms of project scope, objectives, and schedules. The TM ensures site-specific SQAP implementation, serves as the primary point of contact for project problem resolution, and has approving authority for the project.

1.1.2 EPA Region 10 Quality Assurance Officer

The EPA Quality Assurance Manager (QAM), or designee, reviews and approves the site-specific SQAP and revisions in terms of Quality Assurance (QA) aspects. The QAM, or designee, may conduct assessments of field activities.

1.1.3 EPA, Region 10, Regional Sample Control Coordinator

The EPA Regional Sample Control Coordinator (RSCC) coordinates sample analyses performed through the EPA Contract Laboratory Program (CLP), the EPA Region 10 Manchester Environmental Laboratory (MEL), or both and provides sample identification numbers.

1.1.4 E & E START-3 Site Assessment Project Leader

The Ecology & Environment, Inc. (E & E), Superfund Technical Assessment and Response Team (START)-3 Project Leader (PL) provides for the overall coordination of all START Site Assessment projects, ensuring that projects are technically consistent, accurate, and compliant with the overall goals of the EPA Site Assessment Program.

The Site Assessment PL is the EPA point of contact for all Site Assessment program questions and the alternative point of contact for all site assessment projects.

1.1.5 E & E START-3 Project Manager

The E & E START-3 Project Manager (PM) provides overall coordination of field work and provides oversight during the preparation of the site-specific

SQAP. The PM implements the final approved version of the site-specific SQAP, records any deviations from the SQAP, and acts as the primary contact point with the EPA TM. The PM receives CLP/EPA Region 10 laboratory information from the RSCC, acts as the primary START-3 point of contact for technical problems, and is responsible for the execution of decisions and courses of action deemed appropriate by the TM. In the absence of the START-3 PM, a START-3 site manager will assume the PM's responsibilities.

1.1.6 E & E START-3 Quality Assurance Officer

The Quality Assurance Officer (QAO) reviews and approves the site-specific SQAP, conducts in-house audits of field operations, and is responsible for auditing and reviewing the field activities and final deliverables and for proposing corrective action for nonconformities, if necessary.

1.1.7 E & E START-3 Analytical Coordinator

The E & E START-3 Analytical Coordinator (AC) receives the CLP/EPA Region 10 laboratory information from the EPA RSCC. The AC also receives validated data from the EPA chemists.

1.1.8 EPA Project Officer and E & E START-3 Program Manager

The Project Officer (PO) is responsible for coordinating resources requested by the TM for this project and for the overall execution of the START-3 program.

The START-3 Program Manager is responsible for the overall execution of E & E resources for the START-3 contract.

1.2 Problem Definition/Background

Pursuant to EPA START--3 Contract Number EP-S7-06-02 and Technical Direction Document (TDD) number 10-05-0004, E & E will perform an SI at the South Tacoma Channel Seep (Tacoma Seep) site, which is located near Tacoma, Washington. The SI will consist of limited sampling at potential contaminant source areas for site characterization purposes. Depending on analytical results from this first phase (Phase I), a second phase (Phase II) of the SI may be implemented. If a second phase is determined to be warranted, details of that phase will be outlined in an amendment to this SQAP. This document outlines the technical and analytical approaches E & E will employ during the Phase I SI field work. This document is a combined field operations work plan (FOWP) and site-specific quality assurance project plan (QAPP) for field sampling activities. The combined FOWP/QAPP, hereafter called the SQAP, includes a brief site summary, project objectives, sampling and analytical procedures, and QA requirements that will be used to obtain valid, representative field samples and measurements. The SQAP is intended to be combined with information presented in E & E's (2005a) quality management plan (QMP) for Region 10 START-3. A copy of the QMP is available in E & E's office located at 720 Third Avenue, Suite 1700, Seattle, Washington 98121.

This subsection discusses the site background (subsection 1.2.1), site operations and source characteristics (subsection 1.2.2), and previous investigations into the site (subsection 1.2.3).

1.2.1 Site Background

Information presented in this subsection is based on a review of site background information and South Tacoma Channel Seep Preliminary Assessment (PA) completed by E & E.

1.2.1.1 Site Location

Site Name:	South Tacoma Channel Seep
CERCLIS ID Number:	WAN001002824
Site Address:	Near 800 block of South Tacoma Way
Latitude:	47.23195 North
Longitude:	-122.44711 West
Legal Description:	Range 3 East, Township 20 North, Section 8
County:	Pierce
Congressional District:	9
Site Owner(s):	Central Puget Sound Regional Transit Authority 401 South Jackson Street Seattle, Washington 98104

1.2.1.2 Site Description

The Tacoma Seep is a naturally occurring seep located in the 800 block of South Tacoma Way in Tacoma, Washington (Figures 1-2 and 1-3). The site is located approximately 1 mile southwest of the Thea Foss Waterway and north of Interstate 5, which is north of a residential area. The seep is located south of a commercial area, approximately 0.18 miles east of South M Street and north of South Tacoma Way.

The seep is used as a drinking water source by indigent people (Perkins 2009). The seep was identified during sampling in 2005 conducted by the Washington State Department of Ecology (Ecology), who sampled it as part of continuing groundwater monitoring for the Commencement Bay – South Tacoma Channel Superfund Sites. During this sampling project, volatile organic compound (VOC) contamination was detected in the seep. The Commencement Bay – South Tacoma Channel Superfund Sites and their relationship to the South Tacoma Channel Seep are discussed in further detail below.

1.2.1.3 Site Ownership History

The seep is located on property currently owned by the Central Puget Sound Regional Transit Authority (TA). The property was purchased from the Burlington Northern Santa Fe Railway Corporation (BNSF) on September 28, 2004, as part of the Tacoma to Lakewood Commuter Rail Project. Information regarding ownership history prior to this transfer could not be located; however, based on a license agreement between Central Puget Sound Regional Transit

Authority and the City of Tacoma, it appears that BNSF owned the property from at least 1961 (the year that a permit was issued to BNSF by the City of Tacoma) to 2004, when the TA acquired the property (City of Tacoma 2007; Pierce County 2010).

1.2.2 Site Operations and Source Characteristics

As part of the PA, E & E identified all businesses located near the seep, focusing on those that may store or use VOCs in daily operations. Twenty business addresses were initially identified, with eight of those locations having a likelihood of storing or using VOCs. E & E then obtained a city directory abstract (CDA) from Environmental Data Resources, Inc. (EDR). The CDA listed the occupants of each of the eight addresses in five-year increments as far back as 1960 for selected addresses. In addition to the CDA, Certified Sanborn Maps were utilized to track the historical property usage for the eight potential source locations. Sanborn Maps were obtained for 1969, 1950, 1912, and 1869.

The following list summarizes the locations that may be potential sources of VOC contamination to the groundwater seeps near South Tacoma Way (Figure 1-4).

- **1002 S. 30th Street**: Based on the Sanborn Maps, structures appear at this address as early as 1896. The maps prior to 1969 do not describe the nature of the businesses associated with the structures; however, a hotel supply company label for the structure is on the 1969 map. The structure appears as one building comprising both this address and 1016 S 30th Street. The EDR report indicates that the current occupant, Campbell Cox Floor Covering, has occupied the structure since at least 1992. Patrick Hart, Inc. (a hotel and restaurant equipment company), occupied the structure from at least 1971 until 1992, at the latest (EDR 2009a; b). It is possible that the current occupant may use or store chemicals containing VOCs that are used for affixing flooring.
- **1016 S. 30th Street**: Based on the Sanborn Maps, structures appear at this address as early as 1896. The maps prior to 1969 do not describe the nature of the businesses associated with the structures; however, as noted above, a hotel supply company label for the structure is on the 1969 map. The structure appears as one building comprising both this address and 1002 S 30th Street. The EDR report indicates that the current occupant (Emerald City Weather Proofers) has occupied the structure since at least 2008. Prior occupants include Floor Coverings International (2002), Servicemaster (1997 to 2002), North Coast Electric Company (1987), HD Baker Company (a warehouse) (1981), and Associated Grocers, Inc. (1971 and 1976). The structure was vacant in 1992 (EDR 2009a; b).
- **1022 S. 30th Street**: Based on the Sanborn Maps, structures appear at this address as early as 1896. The maps prior to 1969 do not describe the nature of the businesses associated with the structures; however, the 1969 map indicates the structure is a wholesale grocery warehouse. The current occupant, Michael Myers AED, LLC (an automobile repair service), is not listed in the EDR reports; therefore, it is assumed the business has been at this location

only since 2008 (the first year listed on the EDR report). Prior occupants include Genes Towing, Inc. (2002 and 2008), Core-Mark Distributors, Inc. (1997), Kam Consulting and Construction Management and Williams Roofing Company (1987), and Kam Construction Inc. (1971, 1976, 1981, and 1987 (EDR 2009a; b). Solvents may be used or stored at this facility for use as parts degreasers.

- **1102 S. 30th Street**: Based on the Sanborn Maps, Amusement Mach. Repg. occupied this address as early as 1969. The structure does not appear on Sanborn Maps prior to 1969. The current occupant, Airgas Carbonic, is not listed in the EDR reports; therefore, it is assumed that this business has occupied this location since at least 1997 (the first year listed on the EDR report). Previous occupants include American Dry Ice Corporation (1987, 1992, and 1997) and Sportland Amusement Inc. (1976 and 1981) (EDR 2009a; b). Airgas may store chemicals at the facility that contain VOCs or solvents.
- **1114 S. 30th Street**: The 1969 Sanborn map indicates that this structure was a pipe shed. No structure is apparent on any earlier maps. The current occupant, United Pipe and Supply, Inc., has occupied the structure since at least 1997 (the earliest year presented in the EDR report). Previous occupants include Aviation Pumps and Pipes and Environmental Products (1992), United Supply Company (plumbing supplies [1987]), Tacoma Plumbing Supply Company (1976), and United Supply Company (1976, 1971, and 1966) (EDR 2009a; b). United Pipe and Supply may store or use solvents for use in cleaning plumbing equipment.
- **1212 S. 30th Street**: The Sanborn maps do not depict a structure at this location. The current occupant, Center Electric, appears to have occupied the structure since at least 1971 (the earliest date in which a company is listed in the EDR reports). Additionally, in the EDR reports, Center Electric, Inc., is listed as a motors company (EDR 2009a; b). Based on the information that Center Electric is a motors company, it is possible that solvents are used or stored on the property for use in degreasing motor parts.
- **1108 Center Street:** The Sanborn map for 1969 does not include this location; however, the 1950 map does depict a structure. The nature of the business conducted in 1950 is not indicated on the map. The current occupant, LDI Auto Paints and Equipment, appears to have occupied the structure since at least 1997 (the earliest year, as presented in the EDR report). Previous occupants include Specialized Hobbies (1997 and 2002), Lacquer Distributors (paint supplier; 1992, 1987, 1981, 1976, and 1971), and Northwest Crankshaft Service (auto repair [1966 and 1960]) (EDR 2009a; b). It is possible that solvents are used or stored at the facility for use in degreasing automobile parts.
- **1012 Center Street:** This structure is not presented on any of the Sanborn maps, and the 1969 map does not cover the area where this structure is located. The current occupant, Superior Linen Service, has occupied the structure since at least 1971 (the earliest year presented in the EDR report). Previous occupants include Pantorium Supreme Cleaners (1976, 1966, and 1960); Home Service Company (1966); Tacoma Linen Supply (1966),

Tacoma Superior Laundry (1966), Regal Cleaners (1960), Superior Service Laundry (1960), and Supreme Cleaners and Launderers (1960) (EDR 2009a; b). It is possible that trichloroethene (TCE) is currently or in the past has been used or stored at the facility for use in dry cleaning linens.

1.2.3 Previous Investigations

No known formal previous investigations of this site have been conducted; however, numerous investigations of other sites in the area have been conducted. The seep was discovered during sampling conducted by Ecology in 2005. During that sampling event, water was collected from the seep and analyzed for VOCs by EPA Method 8260 at the EPA Manchester Environmental Laboratory in Manchester, Washington. The initial sample results indicated the presence of VOCs, including TCE at a concentration that exceeded the EPA Safe Drinking Water Act federal maximum contaminant levels (MCLs). The seep was sampled a second time by Ecology in June 2008. These sample results also indicated the presence of TCE at a concentration that exceeded the MCL.

1.2.3.1 Commencement Bay – South Tacoma Channel Superfund Sites

The Commencement Bay South Tacoma Channel Superfund Sites encompasses a 2.5-square-mile area in Tacoma, Washington. The sites have been subdivided into three distinct project areas for management. The three project areas, also referred to as Operable Units (OUs), are the Tacoma Landfill, the South Tacoma Field, and Well 12A. The sites were proposed for listing on the National Priorities List (NPL) in December 1982 and finalized for listing in September 1983. The project area that is nearest to the Tacoma Seep is Well 12A, which is approximately 1.3 miles south-southwest of the seep. The other two OUs are sufficiently distant from the site that they are not expected to be affecting, or be affected by, the Tacoma Seep. For this reason, these two OUs are not further discussed in this SQAP (EPA 2010).

The Well 12A OU includes the contaminated well and the source of contamination of the well, the former Time Oil Company. Well 12A is located on Pine Street between 38th Avenue and South Tacoma Way. Current land use around well 12A is commercial and industrial (EPA 2008a).

Groundwater in the area is used as a drinking water source for the City of Tacoma. Well 12A is one of 13 wells operated by the City of Tacoma in a well field that provides approximately 40% of the summer drinking water supply to the city. The dominant groundwater flow direction is to the southwest when drinking water wells are producing and to the northeast when drinking water wells are not producing. Well 12A is located within the South Tacoma Ground Water Protection District, which is a special zoning overlay district managed by the Tacoma Pierce County Health Department (TPCHD) (EPA 2008a).

Site Discovery:
On four different occasions between July and September 1981, chlorinated organic solvents were detected in Well 12A in parts per billion (ppb) concentrations that were above drinking water criteria. As a result, the City of Tacoma Water Department removed Well 12A from production in September 1981 (EPA 2008a).

Phase I Remedial Investigation:
A Remedial Investigation (RI) was conducted in April 1982 to determine the source, type, and extent of contamination at Well 12A. Eleven groundwater monitoring wells were installed, and the results of subsequent groundwater sampling and analysis revealed the following contaminants of concern:

- 1,1,2,2-tetrachloroethane (1,1,2, 2-PCE) – ranging from 17 to 300 ppb;
- Trans-1,2-dichloroethene (DCE) – ranging from 30 to 100 ppb;
- TCE – ranging from 54 to 130 ppb; and
- Tetrachloroethene (PCE) – ranging from 1.6 to 5.4 ppb.

The results of the RI also determined that the major source of contamination in the well was located generally northeast of Well 12A. The RI concluded that continued pumping of Well 12A could capture the contaminant plume even if other production wells were pumping. This meant that Well 12A could provide a hydraulic barrier to the spread of contamination and protect the rest of the well field. If Well 12A was not pumped to provide a hydraulic barrier, it was hypothesized that other operating wells could be impacted by the contaminant plume and could not be used for drinking water use (EPA 2008a).

Focused Feasibility Study:
In January 1983, the EPA conducted a Focused Feasibility Study (FFS) to determine the most cost-effective treatment for Well 12A that would protect the drinking water supply for the City of Tacoma. The study included an Endangerment Assessment that evaluated the risks to the general population if no action was taken. The FFS recommended that a pump-and-treat system with air stripping be implemented on an interim basis. Carbon adsorption was also considered but was more expensive and so was eliminated from further evaluation (EPA 2008a).

Record of Decision:
On March 18, 1983, the EPA signed a Record of Decision (ROD) for an Initial Remedial Measure. The ROD called for the design and construction of five air stripping towers at Well 12A operating in parallel to treat up to 3,500 gallons per minute (gpm) of contaminated groundwater. The ROD required treatment to be sufficiently protective of consumption of aquatic life if discharged either to Commencement Bay or to the city's sanitary sewer system. Construction of the treatment system was authorized in March 1983, and system startup occurred in July 1983. The system was operated by the City of Tacoma until early November, when production from the well field for peak demand was no longer needed. Since this time, operation of the treatment system has continued on a

seasonal basis (during peak demand) to reduce impacts on the remaining well field and is planned to continue until remediation is complete (EPA 2008a).

Phase II Remedial Investigation/Feasibility Study:
Because the Phase I RI identified only a general source location, the EPA authorized a study of historical solvent use and disposal practices in the suspect area in December 1982. This work included a document review and interviews with owners of businesses in the vicinity of Well 12A. The interviews focused on businesses that might have used perchloric acid (PCA). PCA was selected because few businesses near the well used PCA, reducing the number of potential sources of contamination. In May 1983, the EPA authorized a supplement RI/Feasibility Study (FS) to further define the extent of groundwater contamination and to attempt to locate the source. One of the properties identified during this work was the Time Oil Company. This company's property had been used in the past for various industries, including oil recycling and paint and lacquer manufacturing. Oil recycling and solvent processing began in the early 1920s and continued until 1991, with occasional interruptions due to changes in ownership and a large fire in 1976. Four monitoring wells were installed and sampled. Groundwater located near the Time Oil Company property contained concentrations of TCE, PCA, and DCE in the low parts ppm range, which was substantially higher than the detections in other wells and orders of magnitude higher than concentrations in Well 12A. It was determined that these monitoring wells were at or near the source of contamination. Subsequently, the EPA collected air and surface soil samples north of the Time Oil Property on a BNSF rail spur. The air sampling results indicated low levels of contaminant; however, the soil samples contained "significant" concentrations of TCE and PCA, which confirmed that the property as the source of contamination (EPA 2008a).

Time Oil ceased operations at the facility in 1991. Currently, the facility is used to store heating, ventilation, and air conditioning equipment (EPA 2008a).

1.2.3.2 Commencement Bay – Nearshore/Tideflats

The Commencement Bay Nearshore/Tideflats site covers 12 square miles and includes more than 300 active businesses and approximately 500 identified point and non-point sources of contamination. This site is also divided into the following project areas for management:

- Asarco Tacoma Smelter,0
- Ruston/North Tacoma Study Area,
- Tacoma Tar Pits, and
- Tideflats areas.

Of these project areas, the Tideflats areas are further divided into the following sub-areas:

- St. Paul Waterway,
- Sitcum Waterway,
- Hylebos Waterway,

- Middle Waterway,
- Olympic View Resource Area,
- Thea Foss and Wheeler-Osgood Waterways,
- Puyallup Land Settlement, and
- Source Control.

Of these waterways, the Thea Foss Waterway is nearest to the Tacoma Seep site. Although this site is most likely not connected to the Tacoma Seep, it is discussed here because of its proximity to the Tacoma Seep site and because of the nature of the cleanup.

1.2.3.3 Thea Foss Waterway

The Thea Foss Waterway is the westernmost waterway in Commencement Bay and is oriented north/south. The land adjacent to the waterway was primarily industrial from the 1890s to the 1980s. Contaminants associated with the waterway include metals, semivolatile organic compounds (SVOCs), and polychlorinated biphenyls (PCBs). Cleanup activities associated with the waterway have included source-control actions and dredging sediments in the waterway (EPA 2004).

1.3 Migration/Exposure Pathways and Targets

This subsection discusses the migration/exposure pathways and potential targets within the site's range of influence. This site consists only of a seep, the nearest water body is greater than one mile, and exposed contaminated soil is not known to be present; therefore, only the groundwater migration pathway is being evaluated.

1.3.1 Ground Water Migration Pathway

The target distance limit (TDL) for the groundwater migration pathway is a 4-mile radius that extends from the sources at the site. Figure 1-5 depicts the groundwater 4-mile TDL.

1.3.1.1 Geologic Setting

Consolidated and unconsolidated rock characterizes the geology in the general area of the site, with several types of formations that have very different characteristics and origins. The consolidated rocks are, for the most part, the oldest in the area (ranging from Eocene to Miocene in age) and constitute the bedrock upon which the younger, unconsolidated rocks were deposited (Walters and Kimmel 1968).

One formation that likely underlies the site is the Salmon Springs drift. This is a third glaciation that has been discovered in the area. The drift consists primarily of stratified sand and gravel containing thin, discontinuous beds of silt and clay. Lenses of till are present, but no extensive single till sheet has been found. The unit is derived principally from the central Cascades, but sediments of northern derivation are common, and sediments of Mount Rainier provenance are abundant locally in some horizons. The unit is commonly oxidized to a yellowish- or

reddish-brown in the zone of aerations. Where oxidized in the zone of saturation, the unit is compact, and springs occur as a result of the low permeability of the compacted materials (Walters and Kimmel 1968).

Another formation that is likely to underlie the site is the Kitsap Formation, which is composed of beds of fluvial and marsh deposits derived principally from older Pleistocene age deposits and from Mount Rainier sources. In most of the area, the formation consists of three parts: unoxidized sand and gravel at the base, fine-grained material in the middle, and oxidized sand and gravel at the top. The formation unconformably overlies drifts of probable Salmon Spring age. The basal gravel is brownish-black and of unknown thickness. Overlying this deposit are beds of clay, silt, and fine sand that contain discontinuous peat layers near the top,. The color of most of the clay and silt deposits is yellowish-brown or yellowish-orange; some silty, sandy clay is a grayish-blue-green. The Kitsap Formation was deposited in a non-glacial climate during an interval between glaciations. Evidence of both alluvial and lacustrine environments is present in most exposures of the formation. The presence of sediments derived from Mount Rainier indicates that the Puget Sound Lowland was free of ice, thus permitting northward drainage toward the Strait of Juan de Fuca during accumulation of the materials that compose the formation. The following is a typical horizon of this formation with thickness in feet (Walters and Kimmel 1968).

Material	Thickness (feet)
Gravel - cobble, yellowish-brown, compact; Mount Rainer central Cascade and northern Cascade provenance	7
Clay - silty yellowish-brown, with thin, fine, sand beds	1.5
Peat	0.2
Clay - organic-rich and black at top, grades downward into dark yellowish-orange	1.5
Sand - pale yellowish-brown; mainly of Mount Rainier provenance	1.2
Gravel and sand - dark yellowish-orange, compact; contains rocks of Mount Rainier, central Cascades, and northern Cascades provenance. Sand mainly of Mount Rainier provenance	24
Covered	6
Probable Erosional Unconformity	
Clay - dark yellowish-orange, contains thin sand beds	2
Sand - pale yellowish-brown and moderate yellowish-brown	4.5
Clay - pale yellowish-brown to grayish-orange	1.0
Sand - fine, pale yellowish-brown	0.8
Clay - dark yellowish-orange, massive	2.4

Material	Thickness (feet)
Gravel - pebble to cobble, containing sand lenses near the top, generally unoxidized and brownish-gray, Mount Rainier, central Cascades, and northern Cascades provenance, many reworked stained pebbles	20+
Exposed thickness of Kitsap Formation	74 +

1.3.1.2 Aquifer System

The Central Pierce County aquifer system consists primarily of unconsolidated sediment deposited by glaciers and associated meltwater during the Quaternary Period. The groundwater moves regionally toward Puget Sound, and the river valleys that constitute the aquifer system boundaries. Locally, the direction and gradient of groundwater movement can vary dramatically from the overall regional trend (EPA 1998).

Depth to groundwater varies from zero to hundreds of feet. Deep wells drilled within the area penetrate multiple productive aquifers of permeable glacial outwash separated by relatively impermeable aquitards of glacial till or non-glacial sediments. The degree of hydrologic connection between individual aquifer units can vary greatly (EPA 1988).

The site is located in the northeastern portion of the Tacoma Upland. Groundwater in this area is recharged by precipitation. Groundwater flow is controlled by the geology and topography in the area. The unconsolidated glacial drift and alluvium that underlie the area contain aquifers of high porosity and permeability and yield large amounts of water (Griffin and Sceva et al.1962).

The sand and gravel aquifers are discontinuous and occur as lenses and, therefore, the amount of water available differs from place to place. The outwash sands and gravels of the Vashon glaciation comprise the best aquifers in the area. In general, these deposits do not extend more than 200 to 300 feet below the surface (Griffin and Sceva et al. 1962).

In the Tacoma Upland, outwash sands and gravel deposits and the underlying pre-Vashon (Kitsap Formation) unconsolidated deposits include the most productive aquifers. Glacial till and the older semi-consolidated sediments generally yield only small amounts of water (Griffin and Sceva et al. 1962).

Part of the Tacoma Upland is mantled by till from the Vashon glaciation in an unsorted mixture of clay, silt, sand, gravel, and boulders, which was deposited during the last glacier advance into the Tacoma area. The till is generally light gray, almost having the appearance of concrete, and does not form a productive aquifer. However, in areas where till is sufficiently thick (20 to 30 feet) it can yield a small amount of water in large-diameter wells (Griffin and Sceva et al. 1962).

The outwash deposits, consisting mostly of coarse sands and gravels, form the most productive aquifers in the Tacoma Upland. These deposits were deposited by meltwater streams during both the advance and recession of glaciers. The recessional outwash material in this area is mostly coarse gravel and ranges from a few feet to more than 200 feet thick. The advance outwash materials, which are as much as 100 feet thick, generally contain a larger proportion of sand than the recessional outwash (Griffin and Sceva et al. 1962).

For the Tacoma area as a whole, the contact between the Vashon-age deposits and the pre-Vashon unconsolidated deposits is unconformable. This contact ranges from 700 feet above sea level to as much as 300 feet below sea level (Griffin and Sceva et al. 1962).

1.3.1.3 Drinking Water Targets

Approximately 164,040 people use groundwater for drinking water purposes within the 4-mile TDL. A combination of Group A and Group B community water systems and domestic wells are present. The Washington Administrative Code (WAC) defines the group designation for community water systems. Water system group definitions as provided by the Washington State Department of Health (DOH) are as follows:

> **Group A.** (WAC 246-290). Group A water systems are those with 15 or more service connections, regardless of the number of people, or systems serving an average of 25 or more people per day for 60 or more days within a calendar year, regardless of the number of service connections. Group A water systems do not include systems serving fewer than 15 single-family residences, regardless of the number of people.
>
> **Group B** (WAC 246-291). Group B water systems serve fewer than 15 residential connections and fewer than 25 people per day or 25 or more people per day less than 60 days per year. Group B water systems are those public water systems that do not meet the definition of a Group A water system.

The Washington State DOH maintains records of all active public water systems. Public water systems, regardless of group designation, indicate the total number of wells in the system, number of connections, and total population served. A search of the DOH Sentry Internet database revealed that seven Group A community well systems serve a total population of 164,040 people, and 10 Group B community wells serve a total population of 53 people (DOH 2009). All of the Type B wells are located 3 to 4 miles from the site. Wells and associated population are presented by distance ring in Table 1-1.

The Elmwood Mobile Manor maintains one well which serves a population of 60 residents. This well is located 2 to 3 miles from the site.

The Valleybrook Village maintains one well that serves a population of 65 residents. This well is located 2 to 3 miles from the site.

The Tacoma Country Estates maintains one well that serves a population of 231 residents. This well is located 3 to 4 miles from the site.

The Golden Valley water system maintains a well system consisting of two wells, both of which are located within the TDL. The total population served is 200 people. Neither of the wells contributes more than 40% of the total capacity; therefore, each well is assumed to serve approximately 100 people. Both wells are located between 3 and 4 miles from the site.

The Fife Department of Public Works maintains a well system of five wells. All of these wells are emergency wells and are used in the summer months. The City of Fife has an intertie system with the City of Tacoma Water Division. Of these five wells, one is located within the TDL. The population served by the system totals 7,610 people. No well supplies more than 40% of the total capacity; therefore, each well is assumed to serve 1,522 people (7,610 people/five wells). All of these wells are located between 3 to 4 miles from the site.

The City of Fircrest maintains a well system consisting of seven wells. All of the wells are located within the TDL. One of these wells is an emergency well that is maintained and used at least once per year. The population served by the system totals 6,080 people. No well supplies more than 40% of the total capacity; therefore, each well is assumed to serve 869 people (6,080 people/seven wells). Three of the wells are located between 2 to 3 miles from the site, and four of the wells are located between 3 to 4 miles from the site.

The City of Tacoma maintains a system consisting of 32 sources, including 30 wells, a water intake on the Green River, and a spring. Sixteen of these wells are located within the TDL; one of the wells is permanent, 14 are seasonal, and one is an emergency well. Both the permanent and seasonal wells are maintained and used annually, generally in the summer months. None of the wells contribute more than 40% of the total capacity of the system. The system serves a total population of 311,500 people; therefore, each well serves 9,734 people (311,500 people/32 wells and intakes). Five of the wells are located within a 1- to 2-mile radius, three wells are located within a 2- to 3- mile radius, and eight wells are located within a 3- to 4-mile radius.

Finally, a total of 52 domestic drinking water wells are present within the TDL. The average number of people per household for Pierce County, Washington is 2.60 (DOC 2001). Based on this, it is estimated that approximately 135 people use drinking water from a domestic well source. Drinking water population by distance ring is presented in Table 1-1.

The site is located within a designated wellhead protection area.

1.4 Areas of Potential Contamination

Sampling under the Tacoma Seep SI will be conducted at those areas considered potential contamination sources and at areas that may have been contaminated through the migration of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)-regulated hazardous substances from sources on site. Based on a review of background information, the following areas or features have been identified for inspection under the Tacoma Seep SI.

Sources:

Eight addresses were identified and presented in Section 1.2.2 as locations in which the former or current businesses may have used or stored chemicals containing VOCs. These businesses are located near the seep and could potentially be sources of contamination to the ground water. Phase I of this SI will be conducted by collecting samples of the seep water. Phase I is being completed first help determine the concentrations of potential contaminants of concern (COCs). If COCs are detected within the seep water, Phase II will focus on potential sources. The COCs are VOCs.

Targets:

Groundwater: Contaminants from potential sources may be migrating to groundwater. This SI will assist in determining if, and to what degree, contaminants are impacting the groundwater seeps along South Tacoma Way. Potential primary COCs are VOCs. However, this SI will also include analysis for SVOCs, pesticides/ PCBs, Total Petroleum Hydrocarbons (TPH) as gasoline, TPH as diesel, and Target Analyte List (TAL) metals to determine whether additional contaminants are present in the seep.

1.5 Project/Task Description and Schedule

This subsection provides the project description (subsection 1.5.1) and proposed schedule (subsection 1.5.2).

1.5.1 Project Description

This subsection defines the objectives and scope for performing the Phase I SI activities at the Tacoma Seep site. The main goals for the Phase I SI activities are to:

- Collect and analyze samples from seeps to characterize water quality;
- Determine if a Phase II SI is needed and how extensive it will need to be, based on the analytical results of the Phase I SI;
- Determine potential for off-site migration of contaminants;
- Provide the EPA with adequate information to determine whether the site is eligible for placement on the NPL; and
- Document a threat or potential threat to public health or the environment posed by the site.

1.5.2 Schedule

The schedule for implementing the Phase I Tacoma Seep SI is intended to be used as a guide. Adjustments to the implementation dates and the estimated project duration may be necessary to account for various unforeseen or unavoidable conditions that the field team may encounter. Examples include inclement weather, difficulties in accessing a sampling site, unforeseen site conditions, or additional time needed to complete a task. Significant schedule changes that arise in the field will be discussed with the TM at the earliest possible opportunity.

The START-3 is targeting the week of August 30, 2010 as the earliest period to conduct the Phase I SI field work, which is estimated to take one day, including travel time to and from the site. This period comprises one day of mobilization, demobilization, and field activities. Work will be conducted during daylight hours only. If it is determined that a Phase II SI is warranted based on Phase I analytical results, that date will be set at a later time. The work conducted under Phase II will be described and documented in an amendment to this SQAP.

The proposed schedule of Phase I project work is presented in table 1-2:

1.6 Quality Objectives and Criteria for Measurement Data

The project data quality objectives (DQOs) are to provide valid data of known and documented quality to characterize sources, to determine off-site migration of contaminants, to determine whether the site is eligible for placement on the NPL, and to document threat(s) or potential threat(s) to public health or the environment posed by the site. The DQO process applied to this project follows that described in the document *Guidance for the Data Quality Objectives Process* (EPA 2006). See subsection 2.5 for a detailed measurement criteria discussion.

1.6.1 DQO Data Categories

All samples collected under this SQAP will be analyzed using definitive analytical methods. All definitive analytical methods employed for this project will be methods approved by the EPA. The data generated under this project will comply with the requirements for this data category as defined in *Data Quality Objectives Process for Superfund* (EPA 1993).

1.6.2 Data Quality Indicators

Data quality indicators (DQI) representativeness, comparability, completeness, precision, and accuracy goals for this project were developed following guidelines presented in the EPA *Guidance for Quality Assurance Project Plans*, EPA QA/G-5 (EPA 2002).

The basis for assessing each of the elements of data quality is discussed in the following subsections. Subsection 2.5 presents the QA objectives for measurement of analytical data and quality control (QC) guidelines for precision and accuracy. Other DQI goals are included in the individual Standard Operating Procedures (SOPs) in Appendix A and in the Laboratory Statement of Work (SOW).

1.6.2.1 Representativeness

Representativeness is a measure of the degree to which data accurately and precisely represent a population, including a sampling point, a process condition, or an environmental condition. Representativeness is the qualitative term that should be evaluated to determine that measurements are made, and physical samples collected, at locations and in a manner resulting in characterizing a matrix or media. Subsequently, representativeness is used to ensure that a sampled population represents the target population, and an aliquot represents a sampling unit. This SQAP will be implemented to establish representativeness for this project. Further, all sampling procedures detailed in the SQAP will be followed to ensure that the data are representative of the media sampled. The SQAP describes the sample location, sample collection, and handling techniques that will be used to avoid contamination or compromise sample integrity, and ensure proper chain-of-custody of samples. Additionally, the sampling design presented in the SQAP will ensure that there are a sufficient number of samples and level of confidence that analysis of these samples will detect the chemicals of concern, if present.

1.6.2.2 Comparability

Comparability is the qualitative term that expresses the measure of confidence that two data sets or batches can contribute to a common analysis and evaluation. Comparability with respect to laboratory analyses pertains to method type comparison, holding times, stability issues, and aspects of overall analytical quantitation. The following items are evaluated when assessing data comparability:

- Determining if two data sets or batches contain the same set of parameters;
- Determining if the units used for each data set are convertible to a common metric scale;
- Determining if similar analytical procedures and quality assurance were used to collect data for both data sets;
- Determining if the analytical instruments used for both data sets have approximately similar detection levels; and
- Determining if samples within data sets were selected and collected in a similar manner.

To ensure comparability of data collected during this investigation to other data that have been or may be collected for each property, standard collection and measurement techniques will be used.

1.6.2.3 Completeness

Completeness is calculated for the aggregation of data for each analyte measured for any particular sampling event or other defined set of samples. Completeness is calculated and reported for each method, matrix, and analyte combination. The number of valid results divided by the number of possible individual analyte results, expressed as a percentage, determines the completeness of the data set. For completeness requirements, valid results are all results not rejected through

data validation. The requirement for completeness is 95% for aqueous samples and 90% for soil and sediment samples.

The following formula is used to calculate completeness:

$$\% \text{ completeness} = \frac{\text{number of valid results x 100}}{\text{number of possible results}}$$

For any instances of samples that could not be analyzed for any reason (holding time violations in which resampling and analysis were not possible, samples spilled or broken, etc.), the numerator of this calculation becomes the number of valid results minus the number of possible results not reported. For this investigation, all samples are considered critical. Therefore, standard collection (as defined in the sampling SOPs of Appendix A) and measurement methods will be used to achieve the completeness goal.

1.6.2.4 Precision

Precision measures the reproducibility of measurements. It is strictly defined as the degree of mutual agreement among independent measurements as the result of repeated application of the same process under similar conditions. *Analytical* precision is the measurement of the variability associated with duplicate (two) or replicate (more than two) analyses. The laboratory control sample (LCS) determines the precision of the analytical method. If the recoveries of the analytes in the LCS are within established control limits, then precision is within limits. In this case, the comparison is not between a sample and a duplicate sample analyzed in the same batch. Rather, the comparison is between the sample and samples analyzed in previous batches.

Total precision is the measurement of the variability associated with the entire sampling and analysis process. It is determined by analysis of duplicate or replicate field samples and measures variability introduced by both the laboratory and field operations. Field duplicate samples and matrix duplicate spiked samples shall be analyzed to assess field and analytical precision, and the precision measurement is determined using the relative percent difference (RPD) between the duplicate sample results.

The following formula is used to calculate precision:

$$RPD = (100) \times \frac{(S1 - S2)}{(S1 + S2)/2}$$

where:

S1 = original sample value
S2 = duplicate sample value

In general, precision less than or equal to 35% relative percent difference will fulfill the DQOs.

1.6.2.5 Accuracy

Accuracy is a statistical measurement of correctness and includes components of random error (variability due to imprecision) and systemic error. It reflects the total error associated with a measurement. A measurement is accurate when the value reported does not differ from the true value or known concentration of the spike and standard. Analytical accuracy is measured by comparing the percent recovery of analytes spiked into an LCS to a control limit. For pesticides, PCBs, VOCs, and SVOCs, system monitoring compound recoveries are also used to assess accuracy and method performance for each sample analyzed. Analysis of performance evaluation (PE) samples may also be used to provide additional information for assessing the accuracy of the analytical data being produced. In general, accuracy between 50% and 150% will fulfill the DQOs.

1.7 Special Training Requirements/Certification

No special training requirements or certifications are required for this project except for the 40-hour Hazardous Waste Operations and Emergency Response class and annual refreshers. Health and safety procedures for E & E personnel are addressed in the E & E site-specific Health and Safety Plan. This document is maintained in E & E's Seattle office. Included in the plan are descriptions of anticipated chemical and physical hazards, required levels of protection, health and safety monitoring requirements and action levels, personal decontamination procedures, and emergency procedures.

1.8 Documentation and Records

This document is meant to be combined with information presented in E & E's (2010b) *Region 10 START-3 Quality Assurance Project Plan*. This information is covered by the SOPs found in Appendix A, sample plan alteration forms found in Appendix B, supplement sample documents found in Appendix C, and the commercial laboratory quality assurance manual, which has been reviewed previously by E & E. A copy of the START QAPP is available in E & E's Seattle office. Standards contained in the SOPs, the START QAPP, and the QMP will be used to ensure the validity of data generated by E & E for this project.

Following the completion of field work and the receipt of analytical data, a report summarizing project findings will be prepared. Project files, including work plans, reports, analytical data packages, correspondence, chain-of-custody documentation, logbooks, corrective action forms, referenced materials, and photographs, will be provided to the EPA TM at the close of the project. A CD-ROM deliverable containing the final report will be provided to the EPA TM as well.

E & E will assemble and fully document a digital data set including all project sampling, analysis, and observation data. These digital data will be made available in a Microsoft-Access format.

E & E will transfer this data set and documentation to the EPA or, if requested, to any other EPA contractor, and shall ensure that any data transferred are received

in an uncorrupted, comprehensible, and usable format. Specific data deliverable elements are presented below.

Data
A summary description of the tables, the sources of information, and other comments is provided below.

Field-Info
The field information table contains all information related to sample collection. A Microsoft Access application, Sample Information System (SIS), will be used to input and store the data. The SIS provides the user with smart data input forms that will only allow for the entry of acceptable data field values. For each sampling event, the SIS will be updated to reflect the new samples collected. Once entered, the information will be checked and corrected where necessary. The table structure is presented below.

Field Name	Type	Size	Description
Sample-Num	Character	10	Sample Number
Station	Character	10	Station Identifier
Date	Date	8	Sample Date
Time	Numeric	4	Sample Time (24-Hour clock)
Sampler	Character	25	Person Name
Matrix	Character	6	Sample Matrix – (i.e., soil boring, groundwater, sediment)
Water Depth	Numeric	5.1	Depth of water as sediment sample
Description	Character	40	Sample Description
Comments	Character	40	Comments

Location
The location table contains sample location coordinate information. The sample locations will be determined using Trimble Pro-XR Global Positioning System (GPS) units. E & E personnel have been trained in the use of these units and have used them in similar projects. For each day or half-day in the field that GPS sample location data is to be collected, the GPS user will create a single file that contains the locations of each sample station. A unique station label will be entered for each sample location. This unique station identifier will be used to link the Location table with the Field-Info table. This information will be downloaded from the GPS unit and imported into the Location table of the Site Data Management System (SDMS). All location data for this project will be stored in decimal degrees and will be referenced to the North American Datum (NAD) 27 horizontal datum. Differential corrections will be made real-time. The table structure is presented below.

Field Name	Type	Size	Description
Station	Character	10	Station Identifier
X-Coord	Numeric	12.6	X-Coordinate, Decimal Degrees
Y-Coord	Numeric	12.6	Y-Coordinate, Decimal Degrees

Lab Analytical

The Lab Analytical table will hold all of the sample analysis results provided by each laboratory analyzing samples. The integrity of each data file received from the labs will be checked and verified. Once the files are received, they will be appended into the SDMS Lab Analytical table. The ASample-num@ field will be used to link the Lab Analytical table with the Field-Info table. The table structure is presented below.

Field Name	Type	Size	Description
Sample-num	Character	10	Sample Number
Lab-id	Character	10	Laboratory Sample Identifier
Method	Character	25	Analytical Method Used
L-Matrix	Character	10	Laboratory Matrix
Cas-num	Character	15	Chemical Abstracts
Analyte	Character	40	Analyte Name
Result	Numeric	12.6	Analysis Result
Qual	Character	6	Sample qualifier
Quantitation-Limit	Numeric	12.6	Sample quantitation limit
Units	Character	10	Results unit
Date	Date	8	Date analyzed
Lab	Character	40	Lab name

For any Geographic Information Systems (GIS) produced maps, E & E shall provide the maps to the EPA in hard copy and digital image (i.e., JPEG) formats.

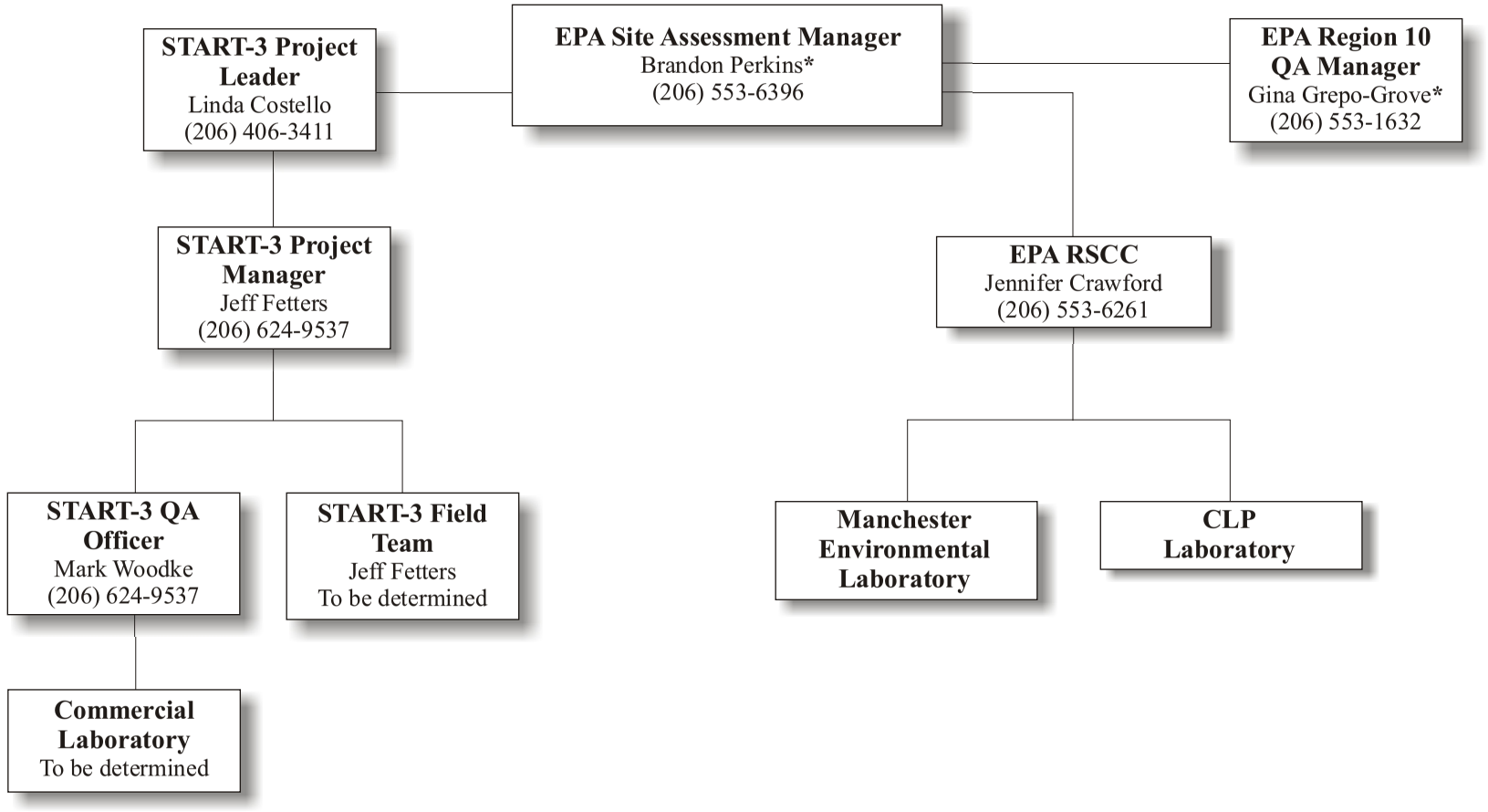
Table 1-1 Drinking Water Population by Distance Ring

Distance Ring	Number of Wells	Population	Total Population for Distance Ring
0 to ¼ mile	0	0	0
¼ to ½ mile	0	0	0
½ to 1 mile	0	0	0
1 to 2 miles	City of Tacoma – 5 wells	48,670	48,675
	Domestic – 2	5	
2 to 3 miles	Elmwood – 1 well	60	31,963
	Valleybrook – 1 well	65	
	Fircrest – 3 wells	2,607	
	Tacoma – 3 wells	29,202	
	Domestic – 11	29	
3 to 4 miles	Tacoma Country Estates – 1 well	231	83,457
	Golden Valley – 2 wells	200	
	Fife – 5 wells	1,522	
	Fircrest – 4 wells	3,476	
	Tacoma – 8 wells	77,872	
	Group B wells	53	
	Domestic – 39	101	
TOTAL			**164,093**

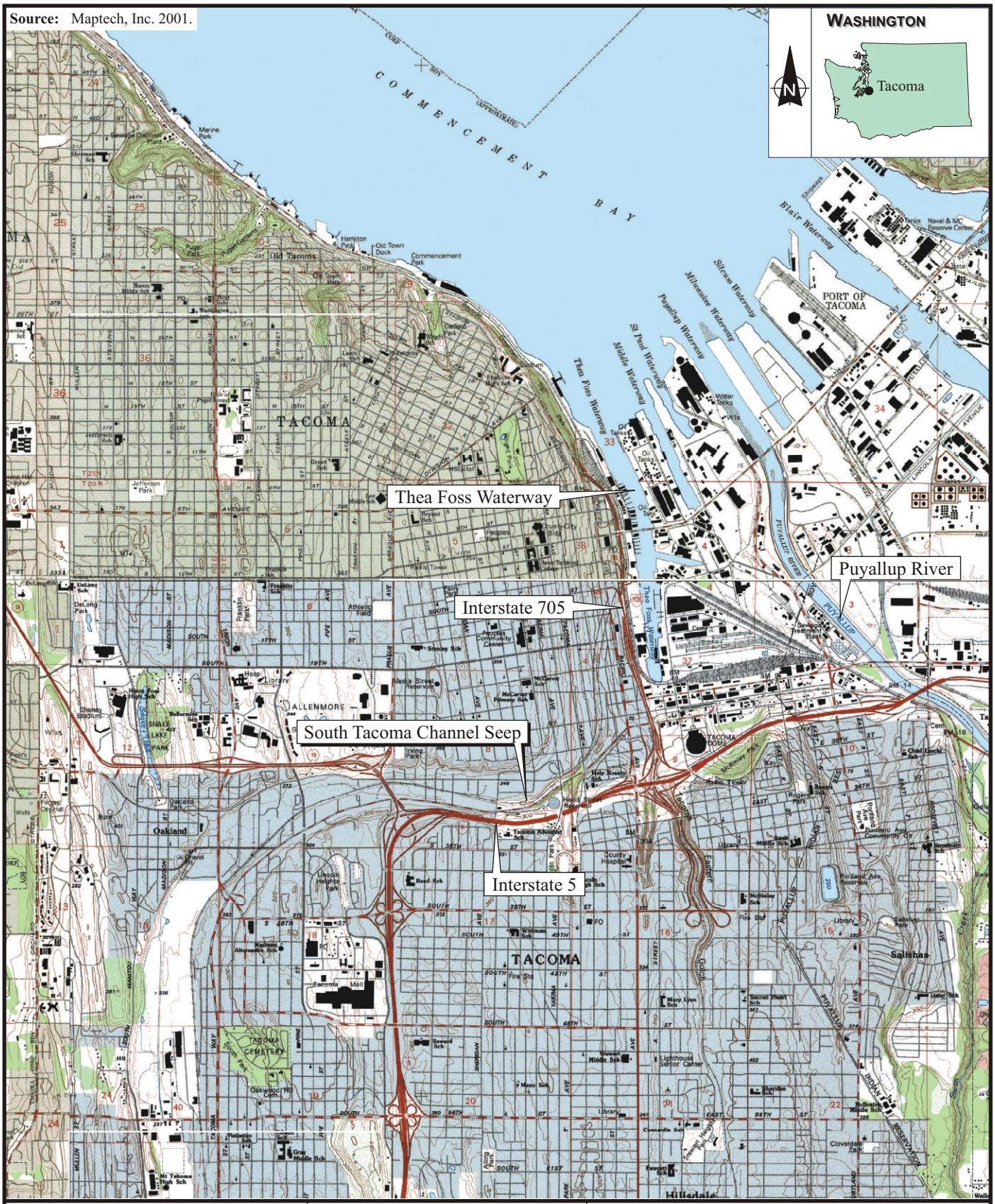
Source: DOH 2009; DOC 2001; Ecology 2009.

Table 1-2 Proposed Schedule

Activity	Start Date	Completion Date
Collect pertinent background information		
Mobilize to the site	August 30, 2010	August 30, 2010
Sample collection activities	August 30, 2010	August 30, 2010
Laboratory receipt of samples	August 31, 2010	August 31, 2010
Demobilization from the site	August 30, 2010	August 30, 2010
Laboratory analysis	August 31, 2010	September 20, 2010
Data validation	September 20, 2010	October 11, 2010
Writing of the project report	August 31, 2010	November 29, 2010
Target project completion date		December 20 2010



ecology and environment, inc. International Specialists in the Environment Seattle, Washington	SOUTH TACOMA CHANNEL SEEP Tacoma, Washington	Figure 1-1 PROJECT ORGANIZATION CHART		
		Date: 7/14/10	Drawn by: AES	10:START-3\10050004\fig 1-1



ecology and environment, inc. International Specialists in the Environment Seattle, Washington	SOUTH TACOMA CHANNEL SEEP Tacoma, Washington	Figure 1-2 SITE VICINITY MAP		
	0 2000 4000 Approximate Scale in Feet	Date: 7-14-10	Drawn by: AES	10:START-3\10050004\fig 1-2

ecology and environment, inc. International Specialists in the Environment Seattle, Washington	SOUTH TACOMA CHANNEL SEEP Tacoma, Washington	Figure 1-3 SITE MAP		
	0 300 600 Approximate Scale in Feet	Date: 7/14/10	Drawn by: AES	10:START-3\10050004\fig 1-3

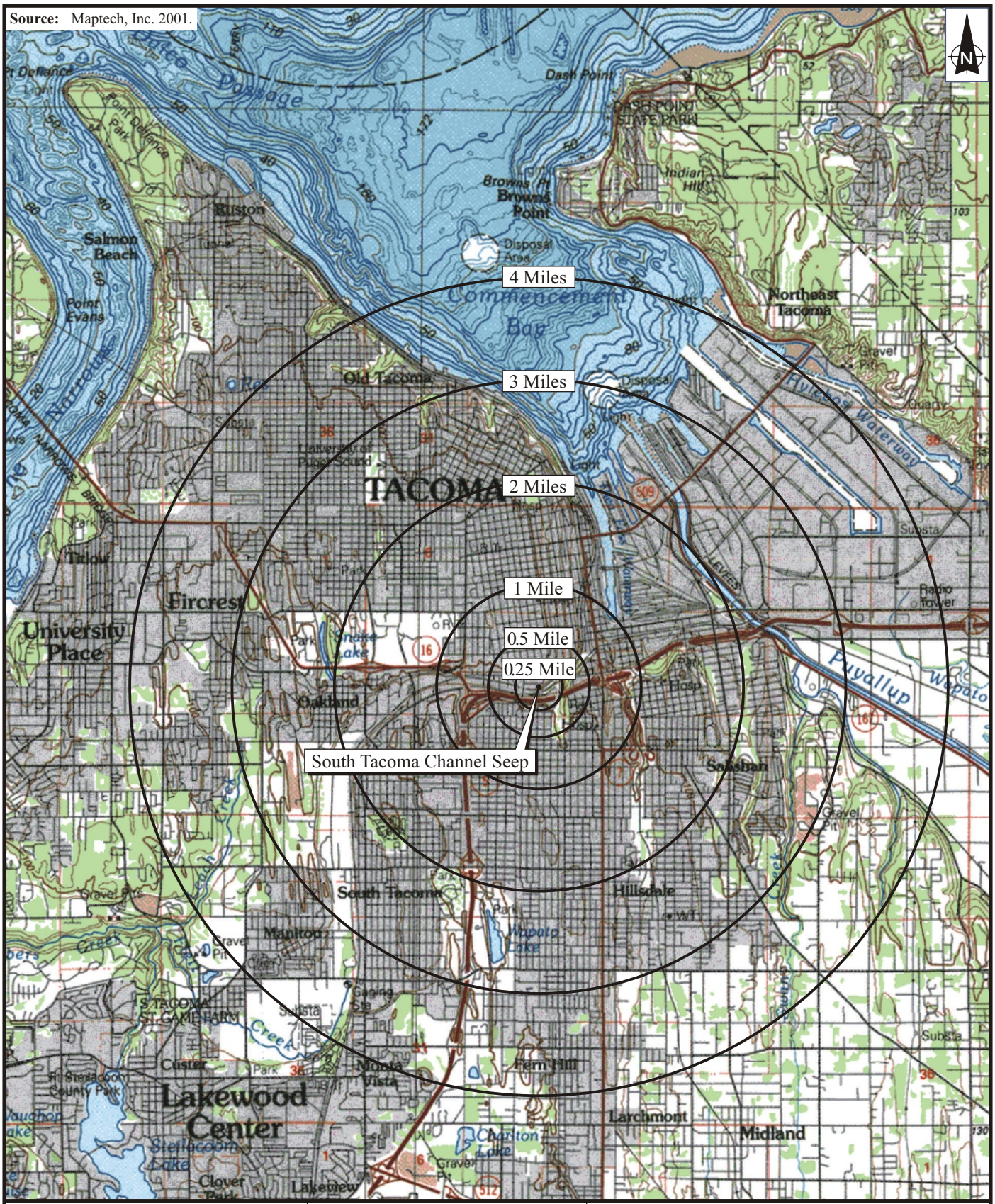
ecology and environment, inc.
International Specialists in the Environment
Seattle, Washington

SOUTH TACOMA CHANNEL SEEP
Tacoma, Washington

0 125 250
Approximate Scale in Feet

Figure 1-4
POTENTIAL SOURCE LOCATIONS

Date:	Drawn by:	
7/15/10	AES	10:START-3\10050004\fig 1-4



ecology and environment, inc. International Specialists in the Environment Seattle, Washington	SOUTH TACOMA CHANNEL SEEP Tacoma, Washington	Figure 1-5 4-MILE MAP		
	0 .5 1 Approximate Scale in Miles	Date: 7-15-10	Drawn by: AES	10:START-3\10050004\fig 1-5

2 Measurement/Data Acquisition

2.1 Sampling Process Design (Experimental Design)

During Phase I of the Tacoma Seep SI, samples will be collected from seeps on site. The locations or features to be sampled have been determined based on information derived from a review of background information and interviews with site representatives. Table 2-1 provides sample information regarding the sampling design and whether the measurement is considered critical or noncritical.

At the time of sampling, site-specific conditions (e.g., topography or visual evidence of contamination) will be evaluated and incorporated, when applicable, into the placement of sampling locations. Other conditions potentially contributing to deviations from the projected sampling locations include new observations or information obtained in the field that warrants an altered sampling approach. Significant deviations from the planned sampling locations or number of samples to be collected will be discussed with the EPA TM before implementation and will be documented on a Sample Plan Alteration Form (SPAF) (Appendix B). Every attempt will be made to collect representative samples with the equipment being used.

This subsection will describe sample locations (subsection 2.1.1), the GPS (subsection 2.1.2), logistics (subsection 2.1.3), cooler return (subsection 2.1.4), and coordination with federal, state, and local authorities (subsection 2.1.5).

2.1.1 Sample Locations

Sample locations will be selected to achieve the objectives discussed in subsection 1.5.1. All samples will be submitted for off-site fixed laboratory analysis. Samples will be analyzed for:

- Pesticides/PCBs (CLP SOM01.2 or EPA SW-846 8081/8082),
- SVOCs (EPA CLP SOW SOM01.2 or EPA SW-846 8270),
- TAL Metals (EPA CLP SOW ILM05.4 or EPA SW-846 6000/7000 Series),
- TPH-D (NWTPH-Dx),
- TPH-G (NWTPH-Gx), and
- VOCs (EPA CLP SOW SOM01.2 or EPA SW-846 8260).

Table 2-2 presents the potential types of samples, analytical methods, specific requirements for sample container size and type, sample preservation and holding times, and special handling requirements for samples expected to be collected at the site. Additionally, Table 2-2 summarizes the number of QA/QC samples to be submitted according to the method requirements. Table 2-3 summarizes the sample coding for the SI sampling event.

A summary of sampling locations is provided below:

Phase I Seep:
Up to three seep water samples will be collected from the site. Specific sample locations will be determined in the field. Samples from the seeps will help determine if contamination is present and whether a Phase II SI is warranted. All samples will be analyzed for Pesticides/PCBs, SVOCs, TAL Metals, TPH-D, TPH-G, and VOCs. Figure 2-1 provides proposed Phase I sampling locations at the site.

Proposed Phase II Sampling:
Based on the results of the Phase I seep sample results and consultation with the EPA Task Monitor, a Phase II field sampling event will occur as soon as possible. This event will include the collection of subsurface soil samples and groundwater samples from borings, if groundwater is encountered, from up to three locations immediately upgradient of the seep locations. The borings will be placed on properties at the following addresses: 1002, 1016, and 1022 South 30th Street. Samples will be collected at 4-foot intervals to the depth of the groundwater, refusal, or 30 feet below the ground surface, which ever is first encountered. The type of sample laboratory analysis to be conducted on the Phase II samples will be determined based on the Phase I results and in consultation with the EPA TM. Figure 2-1 provides proposed Phase I sampling locations at the site. Samples for the Phase II SI have not been included in the tables contained in this section. If Phase II is conducted, an addendum to this SQAP will be prepared to outline sample numbers, analytical methods, and other information relating to sample analysis.

Background:
Because TCE is a non-naturally occurring compound, it is assumed that any detection will be significant. No background sample will be collected as part of the Phase I sampling event. The Phase II background sample location will be determined if Phase II is conducted. If Phase II is conducted, then an addendum to this SQAP will be prepared, outlining sample numbers, analytical methods, and other information relating to sample analysis for that field event.

2.1.2 Global Positioning System

GPS units with data loggers will be used to identify the location coordinates of every sample collected, as well as to delineate the boundaries of the potential source areas. GPS coordinates will be provided in the final Tacoma Seep SI report as an appendix. If real-time coordinates cannot be obtained for the site, the

START-3 will obtain differential correction data from a local source prior to the start of the survey in order to improve the survey resolution.

2.1.3 Logistics

The Tacoma Seep site is accessible by paved road. Field equipment will be driven to the site ensure that all equipment will be available during field work. Property access is being obtained by the EPA.

Sample aliquots collected for fixed laboratory analysis will be delivered to the EPA Region 10 laboratory or an alternative laboratory, as directed by the EPA. All fixed-laboratory samples will be shipped daily or every other day or at the end of the field work by commercial airlines for express delivery. Sample control and shipping are discussed in subsection 2.3.

2.1.4 Cooler Return

For laboratories other than the EPA MEL, E & E will provide completed air bills accompanied by plastic envelopes with adhesive backs and address labels in the chain-of-custody bags taped to the inside of the cooler lids so the laboratory can return the coolers to E & E. The air bills will contain the following notation: "Transportation is for the United States Environmental Protection Agency, and the total actual transportation charges paid to the carrier(s) by the consignor or consignee shall be reimbursed by the Government, pursuant to cost reimbursement contract number EP-S7-06-02." This notation will enable the laboratories to return the sample coolers to E & E's warehouse. The air bills will be marked for third-day economy service and will contain the appropriate TDD number for shipment.

For the EPA MEL or commercial laboratories, an arrangement by E & E for cooler return in this manner is not required.

2.1.5 Coordination with Federal, State, and Local Authorities

The START will keep the EPA TM informed of field event progress and issues that may affect the schedule or outcome of the SI, will discuss problems encountered, will inform the EPA of unusual contacts with the public or the media, and will obtain guidance from the EPA regarding project activities when required. Additionally, the START will notify the EPA RSCC with changes to the sampling schedule for MEL and/or CLP analyses and will provide shipping information on every sample shipment within 24 hours of shipment or before noon on Friday for Saturday delivery. All samples will be shipped to the laboratory within 48 hours of sample collection.

Before initiation of the SI field activities, the EPA will provide notification to the point(s) of contact for the site; property owners/operators, etc.

2.2 Sampling Method Requirements

This subsection describes sampling methodologies (subsection 2.2.1), sampling equipment decontamination (subsection 2.2.2), investigation-derived waste (IDW) subsection 2.2.3), and SOPs (subsection 2.2.4).

2.2.1 Sampling Methodologies

The START-3 PM and EPA TM will be responsible for ensuring that appropriate sample collection procedures are followed and will take appropriate actions to correct the deficiencies. All samples collected will be maintained under chain-of-custody and will be stored and shipped in iced coolers.

Seep Sampling. Seep water samples will be collected either by hand-dipping the sample container into the water, if possible, or by creating a funnel with a dedicated 1-liter polyethylene sample bottle with the bottom of the bottle removed. Samples will be preserved as required.

2.2.2 Sampling Equipment Decontamination

Samples will be collected using only dedicated field sampling equipment. Sampling equipment decontamination will not be required for Phase I SI field activities.

2.2.3 Investigation-Derived Waste

The START field team members will make every effort to minimize the generation of IDW throughout the field event. Disposable personal protective clothing and sampling equipment generated during field activities will be rendered unusable by tearing (when appropriate), bagged in opaque plastic garbage bags, and disposed of at the local municipal landfill.

2.2.4 Standard Operating Procedures

The START will utilize the following SOPs (Appendix A) while performing field activities:

- Field Activity Logbooks;
- Sample Packaging and Shipping; and
- Surface Water (Seep) Sampling.

2.3 Sample Handling and Custody Requirements

This subsection describes sample identification and chain-of-custody procedures that will be used for the Tacoma Seep SI field activities. The purpose of these procedures is to ensure that the quality of the samples is maintained during collection, transportation, storage, and analysis. All chain-of-custody requirements comply with E & E's SOPs for sample handling. All sample control and chain-of-custody procedures will follow the EPA's (2007) *Contract Laboratory Program Guidance for Field Samplers*.

Examples of sample documents used for custody purposes are provided in Appendix D (with the exception of field logbooks) and include the following:

- Sample identification numbers,

- Sample tags or labels,
- Custody seals,
- Chain-of-custody records or traffic reports,
- Field logbooks,
- Sample Collection Forms, and
- Analytical request forms.

During the field effort, the site manager, or delegate, is responsible for maintaining an inventory of these sample documents. This inventory will be recorded in a cross-referenced matrix of the following:

- Sample location,
- Sample identification number,
- Analyses requested and request form numbers,
- Chain-of-custody record numbers,
- Bottle lot numbers, and
- Air bill numbers.

Brief descriptions of the major sample identification and documentation records and forms are provided below.

2.3.1 Sample Identification

All samples will be identified using the sample numbers assigned by the EPA RSCC. Each sample label will be affixed to the jar and covered with clear tape. A sample tracking record will be kept as each sample is collected. The following will be recorded: location, matrix, sample number, observations, and depth. In addition to the EPA-assigned sample number, samples will be tracked with a sample code system designed to allow easy reference to the sample's origin and type. The sample code key will not be provided to the laboratory. Table 2-3 summarizes the sample tracking and location codes.

2.3.1.1 Sample Tags and Labels

Sample tags attached to or fixed around sample containers will be used to identify all samples collected in the field. The sample tags will be placed on bottles so as not to obscure any QA/QC lot numbers on the bottles, and sample information will be printed legibly. Field identification will be sufficient to enable the information to be cross-referenced with the project logbook. For chain-of-custody purposes, all QA/QC samples will be subject to the same custodial procedures and documentation as site samples.

To minimize handling of sample containers, labels will be completed before sample collection, to the greatest extent possible. In the field, the labels will be filled out completely using waterproof ink, then attached firmly to the sample containers and protected with clear tape. The sample labels will provide the following information:

- Sample number,
- Sample location number,
- Date and time of collection,

- Analyses required, and
- pH and preservation (when required).

2.3.1.2 Custody Seals

Custody seals are preprinted gel-type seals, designed to break into small pieces if the seals are disturbed. Sample shipping containers (e.g., coolers, drums, cardboard boxes, etc., as appropriate) will be sealed in as many places as necessary to ensure security. Seals will be signed and dated before use. Clear tape will be placed over the seals to ensure that the seals are not broken accidentally during shipment. Upon receipt at the laboratory, the custodian will check (and certify by completing the package receipt log) that seals on shipping containers are intact.

2.3.1.3 Chain-of-Custody Records and Traffic Reports

For samples to be analyzed at the EPA MEL or at a CLP laboratory, the chain-of-custody records, analyses required forms, and/or analytical traffic report forms will be completed as described in the *Contract Laboratory Program Guidance for Field Samplers* (EPA 2007). The EPA's FORMS II Lite software will be used to electronically enter information for the chain-of-custody and traffic report forms. The chain-of-custody record, analyses required forms, and analytical traffic reports will be completed fully at least in duplicate by the field technician designated by the site manager as responsible for sample shipment to the appropriate laboratory. Information specified on the chain-of-custody record will contain the same level of detail found in the site logbook, except that the on-site measurement data will not be recorded. The custody record will include the following information:

- Name and company or organization of person collecting the samples;
- Date samples were collected;
- Type of sampling conducted (composite or grab);
- Sample number (using those assigned by the EPA RSCC);
- Location of sampling station (using the sample code system described in Table 2-3);
- Number and type of containers shipped;
- Analysis requested; and
- Signature of the person relinquishing samples to the transporter, with the date and time of transfer noted and signature of the designated sample custodian at the receiving facility.

If samples require rapid laboratory turnaround, the person completing the chain-of-custody record(s) will note these or similar constraints in the remarks section of the custody record.

The relinquishing individual will record all shipping data (e.g., air bill number, organization, time, and date) on the original custody record, which will be transported with the samples to the laboratory and retained in the laboratory's file. Original and duplicate custody records, together with the air bill(s) or delivery note(s), constitute a complete custody record. It is the site manager's

responsibility to ensure that all records are consistent and that they become part of the permanent job file.

2.3.1.4 Field Logbooks and Data Forms

Field logbooks (or daily logs) and data forms are necessary to document daily activities and observations. Documentation will be sufficient to enable participants to reconstruct events that occurred during the project accurately and objectively at a later time. All daily logs will be kept in a bound notebook containing numbered pages. All entries will be made in waterproof ink, dated, and signed. No pages will be removed for any reason.

Minimum logbook content requirements are described in the E & E SOP entitled *Field Activity Logbooks,* found in Appendix A. If corrections are necessary, they will be made by drawing a single line through the original entry (so that the original entry is legible) and writing the corrected entry alongside. The correction will be initialed and dated. Corrected errors may require a footnote explaining the correction.

2.3.1.5 Photographs

Photographs will be taken as directed by the team leader. Documentation of a photograph is crucial to its validity as a representation of an existing situation. The following information will be noted in the project or task log concerning photographs:

- Date, time, and location where photograph was taken;
- Photographer (signature);
- Weather conditions;
- Description of photograph taken;
- Reasons why photograph was taken;
- Sequential number of the photograph and the film roll number;
- Camera lens system used; and
- Direction.

2.3.2 Custody Procedures

The primary objective of chain-of-custody procedures is to provide an accurate written or computerized record that can be used to trace the possession and handling of a sample from collection to completion of all required analyses. A sample is in custody when it is:

- In someone's physical possession,
- In someone's view,
- Locked up, or
- Kept in a secured area that is restricted to authorized personnel.

2.3.2.1 Field Custody Procedures

The following guidance will be used to ensure proper control of samples while in the field.

- As few people as possible will handle samples.

- Coolers or boxes containing cleaned bottles will be sealed with a custody tape seal during transport to the field or while in storage before use. Sample bottles from unsealed coolers or boxes, or bottles that appear to have been tampered with, will not be used.
- The sample collector will be responsible for the care and custody of collected samples until they are transferred to another person or dispatched properly under chain of custody rules.
- The sample collector will record sample data in the field logbook.
- The site team leader will determine whether proper custody procedures were followed during the field work and whether additional samples are required.

When transferring custody (i.e., releasing samples to a shipping agent), the following will apply.

- The coolers in which the samples are packed will be sealed and accompanied by two copies of the chain-of-custody record(s). When transferring samples, the individuals relinquishing and receiving them must sign, date, and note the time on each of the chain of custody record(s). This will document sample custody transfer.
- Samples will be dispatched to the laboratory for analysis with separate chain-of-custody records accompanying each shipment. The chain-of-custody records will be signed by the relinquishing individual, and the method of shipment, name of courier, and any other pertinent information will be entered in the chain-of-custody record before placement in the shipping container. Shipping containers will be sealed with custody seals for shipment to the laboratory.
- All shipments will be accompanied by chain-of-custody records identifying their contents. The original custody records kept in a zip-locking bag and taped inside the lid of the cooler will accompany each cooler shipment. The other copies will be distributed appropriately to the site team leader and site manager.
- If sent by common carrier, a bill of lading will be used. Freight bills and bills of lading will be retained as part of the permanent documentation.

2.3.2.2 Laboratory Custody Procedures

A designated sample custodian at the laboratory will accept custody of the shipped samples from the carrier and enter preliminary information about the package into a package or sample receipt log, including the initials of the person delivering the package and the status of the custody seals on the coolers (i.e., broken versus unbroken). The custodian responsible for sample log in will follow the laboratory's SOP for opening the package, checking the contents, and verifying that the information on the chain-of-custody agrees with the samples received. The commercial laboratory will follow its internal chain-of-custody procedures as stated in the laboratory QA manual. The laboratory will check the temperature blank inside the cooler and document it in the sample log-in form. Should the temperature be greater than what is required by the Statement of Work or the method, the sample custodian will inform the region and proceed to follow the course of actions stipulated in the SOW or specified by the regional QAO.

2.4 Analytical Methods Requirements

This subsection discusses the analytical strategy (subsection 2.4.1) and the analytical methods (subsection 2.4.2).

2.4.1 Analytical Strategy

Analysis of samples collected during the SI will be performed by several possible means. The MEL (or alternative laboratory designated by the EPA) will perform all requested analysis.

The analyses to be applied to samples sent to the laboratory are listed in Table 2-2. These analyses were selected based on the probable hazardous substances used or potentially released to the environment, given the known or suspected site usage.

2.4.2 Analytical Methods

Samples designated for off-site analytical laboratory analyses will be submitted to the MEL or an alternative laboratory designated by the EPA and the START-3 subcontracted commercial laboratory. EPA and/or CLP laboratory analyses will take place within the standard three-week turnaround time period (the expedited one-week/two-week turnaround time period), with validation by the EPA QA office for these analyses taking place within the standard three-week turnaround time period. Hardcopy results from the MEL and/or CLP laboratories will be delivered to the EPA upon completion of each sample delivery group. Electronic results from the MEL and/or CLP laboratories will be delivered to the EPA upon project completion. START-3 subcontracted laboratory analyses will take place within the standard four-week turnaround time period, with validation by START-3 chemists for these analyses taking place within the standard two-week turnaround time period. Hardcopy and electronic data results from the subcontracted commercial laboratory will be delivered to the START-3 upon completion of each sample delivery group. Table 2-2 summarizes laboratory instrumentation and methods to be used for the Tacoma Seep SI.

For cases in which laboratory results exceed QC acceptance criteria, reextraction and/or reanalysis will occur as indicated in the applicable analytical method. Commercial laboratory results (preliminary data) will be available within two weeks of sample receipt. Field laboratory results will be available within 24 hours. The respective laboratory analysts will be responsible for ensuring that appropriate sample analysis procedures are followed and for taking appropriate actions to ensure deficiency correction.

2.5 Quality Control Requirements

QC checks for sample collection will be accomplished by a combination of chain-of-custody protocols and laboratory QA procedures as prescribed in the sampling or analytical methods. No QC samples (i.e., double blind performance evaluation samples) are planned for this activity outside of the normal laboratory QC criteria outlined in the analytical methods. These QC samples include blanks, calibration

verifications, spikes, duplicates, (for inorganics) interference check samples, and serial dilutions. Results from these samples will be compared to QC requirements listed in subsection 4.1.2. All of the analyses that will be performed for this project will produce definitive data. Data quality indicator targets for this project are specified in subsection 1.4 (Data Quality Objectives) and are summarized in Table 2-2 of this SQAP. Bias on estimated qualified data shall be determined by the validation process. In accordance with the objectives outlined in this document and the QA levels defined by the EPA (1993), the EPA has defined the DQOs and has determined that the sampling and analyses performed under this sampling effort will conform to the definitive data without quantitative error and bias determination criteria. The laboratories' DQOs for completeness and the field team's ability to meet the DQO for representativeness are set at 90%. Precision and accuracy requirements are outlined in Table 2-2.

One temperature blank consisting of a 40-milliliter glass vial of distilled water will be included in each cooler shipped to the analytical laboratories. Temperature blanks allow the laboratories to obtain a representative measurement of the temperature of samples enclosed in a cooler without disturbing the actual samples. The field team will package and label the temperature blank like a regular water sample, however the analytical laboratory will only measure the temperature of the blank. The temperature blank will not be analyzed for hazardous substances, will not be given a sample number, and will not be listed on the chain of custody form. The temperature blank will be clearly labeled: "USEPA Cooler Temperature Indicator."

2.6 Instrument/Equipment Testing, Inspection, and Maintenance Requirements

The field equipment used during this project includes the GPS unit. Testing, inspection, and maintenance of these instruments will be performed in accordance with the manufacturers' recommendations and/or the SOPs listed in subsection 2.2.4. Spare parts for the field equipment will be available from the manufacturer, generally within 24 hours.

All field instruments and equipment used for analysis will be serviced and maintained only by qualified personnel. All instruments will be maintained by senior staff and/or electronics technicians. All repairs, adjustments, and calibrations will be documented in an appropriate logbook or on a data sheet that will be kept on file. The instrument maintenance logbooks will clearly document the date, the description of the problems, the corrective action taken, the result, and who performed the work.

All equipment used by E & E in the field is subject to standard preventive maintenance schedules established by corporate equipment protocols. When in use, equipment will be inspected at least twice daily, once before startup in the morning and again at the end of the work shift before overnight storage or return to the charging rack. Regular maintenance, such as cleaning of lenses, replacement of in-line filters, and removal of accumulated dust, is to be conducted

according to manufacturers' recommendations and in the field as needed, whichever is appropriate. All performed preventive maintenance will be entered in the individual equipment's logbook and in the site field logbook.

In addition to preventive maintenance procedures, daily calibration checks will be performed at least once daily before use and recorded in the respective logbooks. Additional calibration checks will be performed as required. All logbooks will become part of either the permanent site file or the permanent equipment file.

2.7 Instrument Calibration and Frequency

All instruments and equipment used during fixed laboratory sample analyses will be operated, calibrated, and maintained according to the manufacturers' guidelines and recommendations, as well as criteria set forth in the applicable analytical methodology references and/or in accordance with each laboratory's QA manual and SOPs.

For the field instrumentation (GPS unit and other instrumentation discussed previously), calibrations will be performed in accordance with the manufacturers' recommendations and the SOPs listed in subsection 2.2.4.

2.8 Inspection/Acceptance Requirements for Supplies and Consumables

This information is covered by the SOPs, the START-3 QAPP (E & E 2010b), and the START-3 QMP (E & E 2010a). Standards contained in these documents will be used to ensure the validity of data generated by E & E for this project. Sample jars are pre-cleaned by the manufacturer; certification documenting this is enclosed with each box of jars. The START will include this documentation as part of the site file. Non-dedicated equipment is demonstrated to be uncontaminated by the use of rinsate blanks.

2.9 Data Acquisition Requirements (Nondirect Measures)

No data will be used from other sources.

2.10 Data Management

This document is meant to be combined with information presented in E & E's QAPP and QMP for Region 10 START-3. Copies of the START QAPP and QMP are available in E & E's Seattle office. Standards contained in these documents will be used to ensure the validity of data generated by E & E for this project. Data validation will be performed as listed in subsection 4.1.2. Data tracking, storage, and retrieval are tracked through the TDD "pink sheet," which records where the paper and electronic data are located. All paper data are stored in locked file cabinets; access to these files is restricted to key START-3 personnel. Electronic data will be archived by TDD

Table 2-1 Sample Information Summary

Project Sampling Schedule [a]	Design Rationale	Sampling Design Assumptions	Measurements Classification (Critical/Noncritical)	Nonstandard Method Validation
Water	Determine if contaminants are present.	Contaminants are present in site sources	Critical	N/A

Table 2-2 Sample Analysis Summary and QA/QC Analytical Summary and Fixed Laboratory Analytical Methods

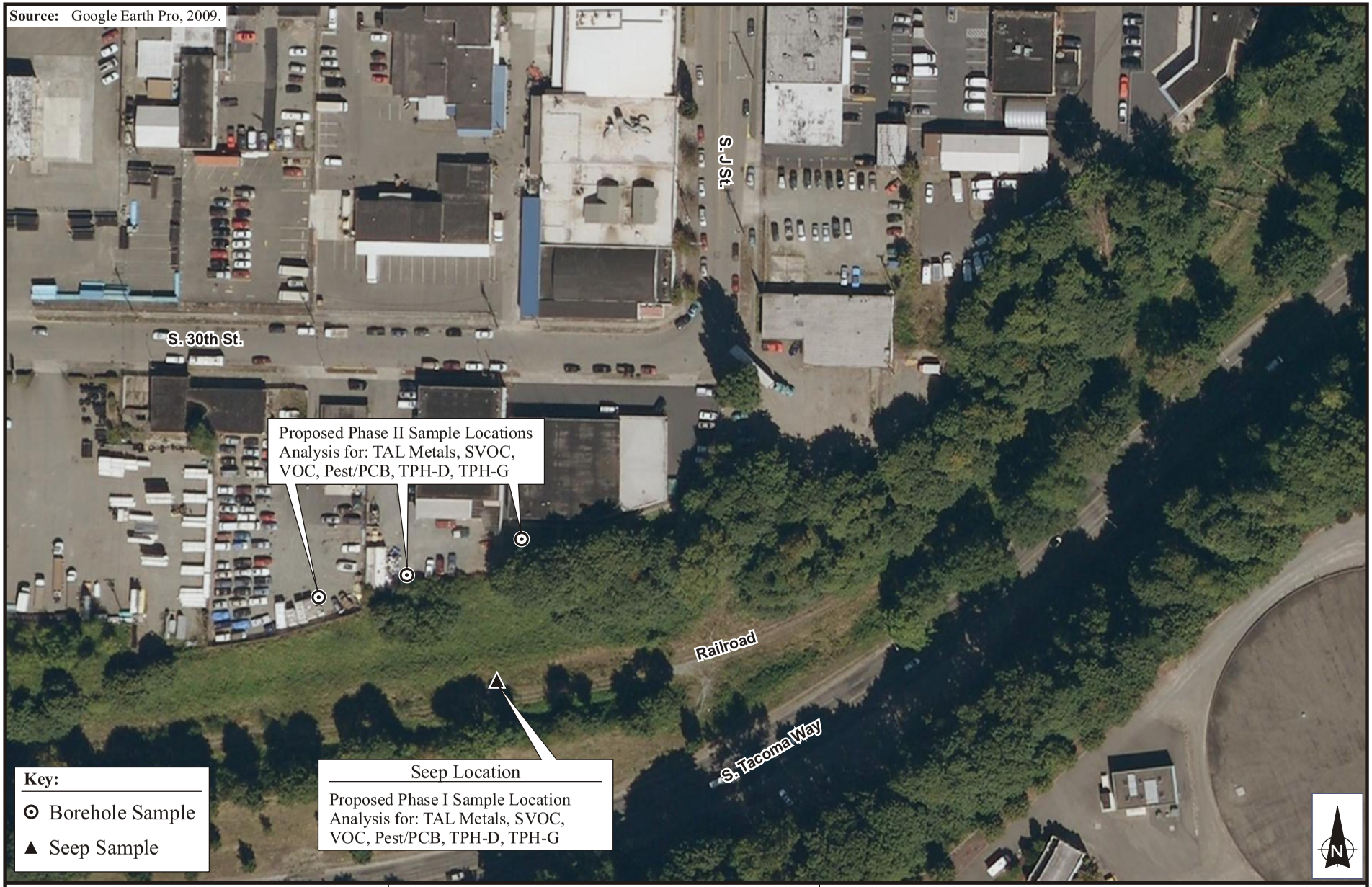
Matrix/ Location [a]	Proposed Laboratory	Analytical Parameters/Methods/Description and Detection Limits	Precision and Accuracy	Technical Holding Times [b]	Sample Preservation (all 4°C ± 2°C)	Sample Containers/MS/MSD Sample Containers	Number of Field Samples	Number of MS/MSD Samples	Number of QA/QC Samples	Total Number of Sample Containers
Water 3 Seeps and 1 Trip Blank	MEL, CLP, Commercial	Pesticides/PCBs/ EPA CLP SOW SOM01.2 or EPA SW-846 8081/8082/ GC-ECD/CRQL	± 20% 60% - 140%	7 days to extraction 40 days to analysis	N/A	2 – 32 ounce glass amber/ 6 – 32 ounce glass amber	3	1	NA	10
		SVOCs/ EPA CLP SOW SOM01.2 or EPA SW-846 8270/ GC-MS/CRQL	± 20% 60% - 140%	7 days to extraction 40 days to analysis	N/A	2 – 32 ounce glass amber/ 6 – 32 ounce glass amber	3	1	NA	10
		TAL Metals/ EPA CLP SOW ILM05.4 or ISM01.2 or EPA SW-846 6000/7000 Series/ ICP and AA/CRQL	± 20% 75% - 125%	6 months (28 days for Hg)	pH ≤ 2 with HNO_3	1 – 1-Liter polyethylene/ 2 – 1-Liter polyethylene	3	1	NA	4
		VOCs/ EPA CLP SOW SOM01.2 or EPA SW-846 8260/ GC-MS/CRQL	± 20% 60% - 140%	7 days unpreserved 14 days preserved	pH ≤ 2 with HCl	3 – 40 milliliter glass/ 6 – 40 milliliter glass	3	1	1	18
		Gasoline Range TPHs/ NWTPH-Gx / GC-FID/250 or 100 µg/L	± 20% 60% - 140%	14 days	pH ≤ 2 with HCl	3 – 40 milliliter glass/ 6 – 40 milliliter glass	3	1	1	18
		Diesel-Range TPHs /NWTPH-Dx/ GC-FID/0.25 mg/L	± 20% 60% - 140%	14 days to extraction 40 days to analysis	pH ≤ 2 with HCl	2 – 32 ounce glass amber/ 6 – 32 ounce glass amber	3	1	NA	10

Note:
a = The number of samples presented is an estimate. The actual number of samples to be collected will be determined in the field.
b = Technical holding times have been established only for water matrices. Water technical holding times were applied to sediment, soil, and product samples where applicable; in some cases, recommended sediment/soil holding times are not listed.

Key:
° C = Degrees Celsius.
AA = Atomic Adsorption
CLP = Contract Laboratory Program.
CRQL = Contract Required Quantitation Limit
ECD = Electron capture detection.
EPA = United States Environmental Protection Agency
FID = Flame Ionization Detector
GC = Gas Chromatograph
HCl = Hydrochloric acid
HNO_3 = Nitric acid
ICP = Inductively coupled argon plasma
MEL = Manchester Environmental Laboratory
MS = Mass spectrometric detection
NA = Not applicable
PCBs = Polychlorinated biphenyls
SOW = Statement of Work
SVOCs = Semivolatile Organic Compounds
TAL = Target Analyte List
TPHs = Total Petroleum Hydrocarbons
µg/L = Micrograms per liter
VOCs = Volatile Organic Compounds

Table 2-3 Sample Coding

Digits	Description	Code	Example
1,2	Source Code	BK	Background
		SP	Seep
3,4	Consecutive Number	01	First Sample of Source Type
5,6	Matrix Code	GW	Ground Water



ecology and environment, inc.
International Specialists in the Environment
Seattle, Washington

SOUTH TACOMA CHANNEL SEEP
Tacoma, Washington

Figure 2-1
PROPOSED SAMPLE LOCATIONS

0 125 250
Approximate Scale in Feet

Date:	Drawn by:	
7/14/10	AES	10:START-3\10050004\fig 2-1

3 Assessment/Oversight

3.1 Assessment and Response Actions

The EPA QAO (or designee) may conduct an audit of the field activities for this project. The auditor will have the authority to issue a stop work order upon finding a significant condition that adversely would affect the quality and usability of the data. The EPA TM will be responsible for initiating and implementing response actions associated with findings identified during the site audit. The actions taken also may involve the EPA PO, contracting officer, and/or QAO. Once the response actions have been implemented, the EPA QAO (or designee) may perform a follow-up audit to verify and document that the response actions were implemented effectively. In-house audits performed by the START-3 may be conducted in accordance with the E & E START-3 *Quality Management Plan* (2010a). No audits are planned for the Tacoma Seep SI.

If major deviations from the QA requirements of the project and the CLP SOW were observed in the data validation process, the EPA QAO will contact the laboratory to correct the problem. If the laboratory is not responsive to the request, the QAO will inform the CLP Regional PO and the TM of the situation. A brief narrative will be written explaining the contract deviations and recommendations will be given based on the quality of the submitted data. Reduced payment and/or reanalysis at the laboratory's expense shall be pursued by the Regional CLP PO. Re-sampling and subsequent re-analysis will be decided by the TM. Additional sampling for corrective actions and/or any addendum to this SQAP shall be documented using the Corrective Action Form and the SPAF (Appendix B). Corrective actions will be conducted in accordance with E & E QMP specifications.

3.2 Reports to Management

The START-3 PM will debrief the EPA TM on a daily basis. Laboratory deliverables will be produced as specified in the CLP Organic and Inorganic Statements of Work (SOM01.1 and ILM05.3, respectively) for CLP data and CLP-equivalent deliverables for MEL data, as specified in the laboratory subcontract bid specification package for commercial laboratory data, and as specified in the Environmental Services Assistance Team contract for on-site analyses. Once the project is complete and the resulting data are obtained, the START-3 PM will prepare a final project report. This report will include a summary of the activities performed during the project and the resulting data (along with any statements concerning data quality). The report will be approved by the EPA TM prior to being forwarded to the individuals identified in the data distribution list located in the Table of Contents section of this SQAP.

The START-3 corrective action program is addressed in Section 3 of the QMP. Corrective actions will be conducted in accordance with these QMP specifications.

4 Data Validation and Usability

4.1 Data Review, Validation, and Verification Requirements

The data validation review of data packages will include an evaluation of the information provided on the analytical data sheets and required support documentation for all sample analyses; the supporting sample collection documentation, including chain-of-custody forms; and documentation of field instrument calibration, sample results, and/or performance checks (if required by the method). The QA review also will examine adherence to the procedures as described in the cited SOPs and the specified analytical methods in the SQAP.

4.1.1 Data Reduction

Data reduction includes all processes that change the numerical value of the raw data. All fixed-laboratory data reduction will be performed in accordance with the appropriate methodology and will be presented as sample results.

4.1.2 Data Validation

Analytical data generated through the CLP contract will be validated in a three-week turn around time by the Region 10 QA office, or its designee. Data generated by the MEL will be validated by the EPA TM–designated validator (i.e., EPA QA office or contractor). Validation of data generated by subcontracted laboratories will be performed by E & E. All data validations will be performed in accordance with the QA/QC requirements specified in the SQAP, the technical specifications of the analytical methods, and the following documents:

- EPA *Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (2010); and
- EPA *Contract Laboratory Program National Functional Guidelines for Organic Data Review* (2008b).

The QC parameters of interest for the EPA organic and inorganic methods that will be used on the Tacoma Seep SI samples are presented in these documents. When applicable, QC criteria listed in the applicable analytical methods and/or the SOW will be used for validation.

Validation deliverables will include a QA memo discussing QA conformance and deviations issues that may have affected the quality of the data. Data usability, bases of application of qualifiers, and percentage of qualified data will also be discussed in the QA memo. The analysis data sheets (Forms I), along with the applied validation qualifiers and bias determination for estimated-qualified

values, will also be a part of the validation deliverables. The following qualifiers shall be used in data validation:

- U = The material was analyzed for but was not detected. The associated numerical value is the sample quantitation limit.
- J = The associated numerical value is an estimated quantity because the reported concentrations were less than the sample quantitation limits or because quality control criteria limits were not met.
- UJ = The material was analyzed for, but not detected. The reported detection limit is estimated because Quality Control criteria were not met.
- R = The sample results are rejected (analyte may or may not be present) due to gross deficiencies in quality control criteria. Any reported value is unusable. Resampling and/or reanalysis is necessary for verification.
- H = High bias.
- K = Unknown bias.
- L = Low bias.
- Q = Detected concentration is below the method reporting limit/Contract Required Quantitation Limit, but is above the method quantitation limit.

4.1.3 Data Assessment Procedures

Following data validation and reporting, all project-generated and -compiled data and information will be reconciled with the objectives specified in subsection 1.3.1 to assess the overall success of SI activities. This data assessment, including points of achievement and departure from project-specific objectives, will be discussed in the QA section of the SI report.

4.2 Data Verification

The analytical QA requirements and data validation requirements will be as specified in subsection 4.1.2 (EPA 2008b and 2010).

The EPA TM will perform the final review and approval of the data. The EPA TM and/or QAO will look at matrix spike/matrix spike duplicates, laboratory blanks, and laboratory duplicates to ensure that they are acceptable. The EPA TM (and/or designee) also will compare the sample descriptions with the field sheets for consistency and will ensure that any anomalies in the data are documented appropriately.

Data QA memoranda reports will be generated as part of the Tacoma Seep SI if the START-3 is responsible for data validation. If the EPA Region 10 QA office, or its designee, performs the data validation, then additional reports regarding data usability will be generated by the START-3.

4.3 Reconciliation with Data Quality Objectives

The data quality indicators target for this project is discussed in subsection 1.4 of this SQAP. The data validation will be used as a tool to determine if these targets were met. Also, using the compiled data, E & E and the TM will determine the

variability and soundness of the data and the data gaps that will need to be filled to meet the objectives of the project.

Once the data results are compiled, the EPA TM and/or the EPA QAO will review the sample results to determine if they fall within the acceptance limits as defined in this SQAP. Completeness also will be evaluated to determine if the completeness goal for this project has been met. If data quality indicators do not meet the project's requirements as outlined in this SQAP, the data may be discarded and resampling and reanalysis may occur. The TM will attempt to determine the cause of the failure (if possible) and make the decision to discard the data and resample. If the failure is tied to the analysis, calibration and maintenance techniques will be reassessed as identified by the appropriate laboratory personnel. If the failure is associated with the sample collection and resampling is required, the collection techniques will be reevaluated as identified by the START-3 PM.

5 References

City of Tacoma, April 19, 2007, *License Agreement Number 080*, Grantor Ventral Puget Sound Regional Transit Authority.

Ecology and Environment, Inc., (E & E), March 2010a, *Quality Management Plan, Superfund Technical Assessment and Response Team (START)-3*, prepared for the United States Environmental Protection Agency, Contract Number EP-S7-06-02.

———, March 2010b, *Quality Assurance Project Plan, EPA Region 10 Superfund Technical Assessment and Response Team (START)-3*, prepared for the United States Environmental Protection Agency, Contract Number EP-S7-06-02.

Environmental Data Resources, Inc. (EDR) October 7, 2009a, Certified Sanborn™ Map Report, Inquiry Number 2607979.1.

———, October 13, 2009b, The EDR City Directory Abstract, Inquiry Number 260797.2.

Griffin, W.C, and J.E. Sceva et al. 1962, *Water Resources of the Tacoma Area, Washington,* Prepared by the US Geological Survey as Water Supply Paper 1499-B in cooperation with the Tacoma Department of Public Utilities, Pierce County, and the Port of Tacoma.

Parametrix/CDM Federal Programs Corporation, (CDM), April 2, 2009, *Final Focused Feasibility Study Well 12A Superfund Site Tacoma Washington*.Prepared for the United States Environmental Protection Agency under contract number 68-S7-03-04 Task Order Number 014A.

Perkins, Brandon. September 15, 2009, Personal communication with Renee Nordeen, Project Manager, Ecology and Environment, Inc., regarding South Tacoma Channel Seep – Message #2.

Pierce County,2010, Electronic Property Information Profile, Parcel Search. http://epip.co.pierce.wa.us/cfapps/atr/epip/search.cfm.

United States Department of Commerce, (DOC) May 2001, *Profiles of General Demographic Characteristics, 2000 Census of Population and Housing, Washington*

United States Environmental Protection Agency (EPA), January 2010, *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review*, Office of Superfund Remediation and Technology Innovation, OSWER 9240.1-51, ESEPA-540-R-10-0011.

———. September 2008a, *Five-Year Review Report, Commencement Bay South Tacoma Channel Superfund Sites*. Third Five-Year Review Report for Well 12A (OU 1/2/3), Seattle, Washington.

———, June 2008b, *USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review*, Office of Superfund Remediation and Technology Innovation, OSWER 9240.1-48, USEPA 540-R-08-01.

———, July 2007, *Final Contract Laboratory Program Guidance for Field Samplers*, Office of Superfund Remediation and Technology Innovation, OSWER 9240.0-44, EPA 540-R-07-06.

———, February 2006, *Guidance on Systematic Planning Using the Data Quality Objectives Progress EPPA QA/G-4*, Office of Environmental Information, EPA/240/B-06/001.

———. December 29, 2004, *Five-Year Review Report: Commencement Bay Nearshore/Tideflats Superfund Site*, Prepared by Region 10 Environmental Cleanup Office.

———, December 2002, *Guidance for Quality Assurance Project Plans EPA QA/G-5*, Office of Environmental Information, EPA/240/R-02/009.

———, 1998, Memorandum from Charles Findley, Director of Water Division to Gerald Emison, Acting Regional Administrator regarding Sole Source Aquifer Determination: Central Peirce County Aquifer System – Action Memorandum.

———, September 1993, *Data Quality Objectives Process for Superfund Interim Final Guidance*, Office of Solid Waste and Emergency Response, Publication 9355.7-01 EPA540-R-93-073 PB94-963203.

Walters, Kenneth L, and Grant E Kimmel. 1968. *Ground-Water Occurrence and Stratigraphy of Unconsolidated Deposits, Central Pierce County, Washington*, Prepared in cooperation with the United States Geological Survey Water Resources Division.

Washington State Department of Ecology (Ecology), 2009, web search of well logs for surrounding area, http://apps.ecy.wa.gov/welllog/textsearch.asp.

Washington State Department of Health (DOH), 2009, web search of public drinking water systems for surrounding area, https://fortress.wa.gov/doh/eh/portal/odw/si/FindWaterSystem.aspx.

A Standard Operating Procedures

Title:	**FIELD ACTIVITY LOGBOOKS**
Category:	DOC 2.1
Revised:	April 1998

STANDARD OPERATING PROCEDURE

FIELD ACTIVITY LOGBOOKS

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TITLE:	**FIELD ACTIVITY LOGBOOKS**
CATEGORY:	DOC 2.1
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TITLE:	FIELD ACTIVITY LOGBOOKS		
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1. Summary

This Standard Operating Procedure (SOP) establishes requirements for the entry of information into logbooks to ensure that E & E field activities are properly documented. The project manager (PM) and the field team leader (FTL) are responsible for ensuring that logbook entries provide sufficient information for the completion of an accurate and detailed description of field operations and meets the requirements of the contract or technical direction document (TDD).

This SOP describes logbook entry requirements for all types of projects, specifies the format that should be used, and provides examples. Some flexibility exists when implementing the SOP because different types of projects require different data collection efforts. This SOP does not address site safety logbook requirements or geotechnical logbook entries.

2. Purpose

Complete and accurate logbook entries are important for several reasons: to ensure that data collection associated with field activities is sufficient to support the successful completion of the project; to provide sufficient information so that someone not associated with the project can independently reconstruct the field activities at a later date; to maintain quality control (QC) throughout the project; to document changes to or deviations from the work plan; to fulfill administrative needs of the project; and to support potential legal proceedings associated with a specific project.

2.1 Adequate Field Information/Quality Control

QC procedures for data collection begin with the complete and systematic documentation of all persons, duties, observations, activities, and decisions that take place during field activities. It is especially important to fully document any deviations from the contract, project scope, work plans, sampling plans, site safety plans, quality assurance (QA) procedures, personnel, and responsibilities, as well as the reasons for the deviations.

Prior to entering the field, the project manager must indicate to the field team what pertinent information must be collected during field activity in order to meet the desired objectives of the data collection effort. The PM is responsible for reviewing the adequacy of the project logbooks both during and following completion of field activities, and is also responsible for meeting with the field team members to discuss any findings and to direct activities to correct any deficiencies, as appropriate. The PM also has the responsibility of ensuring that the logbooks become part of the project or TDD file.

2.2 Work Plan Changes/Deviation

The logbook is the document that describes implementation of the work plan and other appropriate contract documents and provides the basis for the project reports. It must include

detailed descriptions of any and all deviation from the work plan and the circumstances that necessitate such changes. These changes will be reviewed for compliance with data quality objectives and include:

- Changes in procedures agreed to in the project planning stages;
- Any conditions that prevent the completion of the field effort, or that result in additional fieldwork must be noted (i.e., weather delays, government actions, physical obstructions, personnel/ equipment problems, etc.). Persons from whom permission was obtained to make such changes must be clearly documented.
- Any modifications requested by the client or client's representative that are contradictory to the contract or outside of the existing scope of work must be documented in detail because the cost of the project could be affected by such modifications.

2.3 Evidentiary Documentation

Field activity documentation can become evidence in civil and/or criminal judicial proceedings, as well as in administrative hearings. Field logbooks serve this purpose. Accordingly, such documentation is subject to judicial or administrative review. More importantly, it is subject to the review of an opposing counsel who will attempt to discredit its evidentiary value.

The National Enforcement Investigation Center (NEIC) and the United States Environmental Protection Agency (EPA) have prepared documents outlining their documentation needs for legal proceedings. These guidelines indicate the importance of accurate and clear documentation of information obtained during the inspections, investigations, and evaluations of uncontrolled hazardous waste sites. Consequently, attention to detail must be applied by E & E personnel to all field documentation efforts for all E & E projects. Project personnel must document where, when, how, and from whom any vital project information was obtained. This information is necessary to establish a proper foundation for admissible evidence.

3. Guidelines

Logbooks should contain a summary of any meeting or discussion held with a client or with any federal, state, or other regulatory agency that was on site during the field activities. The logbook should also describe any other personnel that appear on site, such as representatives of a potential responsible party (PRP).

The logbook can be used to support cost recovery activities. Data concerning site conditions must be recorded before the response activity or the passage of time eliminates or alters those conditions. Logbooks are also used to identify, locate, label, and track samples and their final disposition. In addition, data recorded in the logbook will assist in the interpretation of the analytical results.

Logbooks are subject to internal and external audits. Therefore, the recorded information should be consistent with and capable of substantiating other site documentation such as time cards, expense reports, chain-of-custody forms, shipping papers, and invoices from suppliers and

subcontractors, etc. Logbooks also act as an important means of reconstructing events should other field documents such as data collection forms become lost or destroyed. Therefore, all mission-essential information should be duplicated in the logbook.

3.1 General Instructions

The following general guidelines must be used for all logbooks:

- At a minimum, one separate field activity logbook must be maintained for each project or TDD.
- All logbooks must be bound and contain consecutively numbered pages.
- No pages may be removed for any reason, even if they are partially mutilated or illegible.
- All field activities must be recorded in the site logbook (e.g., meetings, sampling, surveys, etc.).
- All information must be **printed legibly** in the logbook using water-proof ink, preferably black. If weather conditions do not permit this (i.e., if it is too cold or too wet to write with ink), another medium, such as pencil, may be used. The reason that waterproof ink was not used should be specifically noted in the logbook.
- The language used in the logbook should be objective, factual, and free of personal feelings or terminology that might prove inappropriate.
- Entries should be made in chronological order. Contemporaneous entries are always preferred because recollections fade or change over time. Observations that cannot be recorded during field activities should be recorded as soon after as possible. If logbook entries are not made during field activities, the time of the activity/ observation and the time that it is recorded should be noted.
- The first entry for each day will be made on a new, previously blank page.
- Each page should be dated and each entry should include the time that the activity occurred based on the 24-hour clock (e.g., 0900 for 9 a.m., 2100 for 9 p.m.).
- At the completion of the field activity, the logbook must be returned to the permanent project or TDD file.

3.2 Format

The information presented below is not meant to be all-inclusive. Each project manager is responsible for determining the specific information requirements associated with a field activity logbook. If someone other than the Project Manager is keeping the logbook, the Project Manager is responsible to convey to that individual, prior to the start of fieldwork, specific instructions on what type of information is required to be entered into the logbook. Information requirements will vary according to the nature and scope of the project. (Refer to Appendix A for an example of a completed logbook.)

Title Page

The logbook title page should contain the following items:

- Site name,
- Location,
- TDD No. or Job No.,
- PAN (an EPA site/task identification number), if applicable,
- SSID No. (Site ID number-assigned under CERCLA), if applicable,
- Start/Finish date, and
- Book ___ of ___.

First Page

The following items should appear on the first page of the logbook prior to daily field activity entries:

- TDD No. or Job No.,
- Date,
- Summary of proposed work (Reference work plan and contract documents, as appropriate),
- Weather conditions,
- Team members and duties, and
- Time work began and time of arrival (24-hour clock).

Successive Pages

In addition to specific activity entries and observations, the following items should appear on every logbook page:

- Date,
- TDD or Job No., and
- Signature (bottom of each page). If more than one person makes entries into the logbook, each person should sign next to his or her entry.

Last Page

In addition to specific activity entries and observations and the items that should appear on each successive page, the last page of the logbook should contain a brief paragraph that summarizes the work that was completed in the field. This summary can become especially important later on if more or less work was accomplished during the duration of the field activity.

3.3 Corrections

If corrections are necessary, they must be made by drawing a single line through the original entry in such a manner that it can still be read. *Do not erase or render an incorrect notation illegible*. The corrected entry should be written beside the incorrect entry, and the correction must be initialed and dated. Most corrected errors will require a footnote explaining the correction.

4. Documentation

Although the requirements and content of the field logbook will vary according to the site and the tasks to be performed, the following information should be included in every logbook:

4.1 Prior to Fieldwork

Summary of Proposed Work

The first paragraph of **each** daily entry should summarize the work to be performed on that day. For example:

> "Collect soil and groundwater samples from previously installed wells and ship samples to Analytical Services Center (ASC). Discuss removal with site owner."

The first paragraph becomes especially important later when discussing work plan deviations or explaining why more or less work was accomplished for that day.

Personnel

Each person to be involved in activities for the day, his/her respective role (sampler, health and safety, etc.), and the agency he/she represents should be noted in the logbook.

On-Site Weather Conditions

Weather conditions may have an impact on the work to be performed or the amount of time required to perform the proposed work; therefore, all weather on-site weather conditions should be noted, including temperatures, wind speed and direction, precipitation, etc., and up-dated as necessary. Similarly, any events that are impacted by weather conditions should be noted in the logbook.

Site Safety Meeting

Although minutes should be recorded for all site safety meetings under separate cover, the logbook should briefly summarize the site safety meeting and any specific site conditions and resultant site safety concerns.

4.2 Site Sketch

A site sketch should be prepared on the first day of field activities to indicate prominent site and environmental features. The sketch should be made either to scale or by noting the approximate distances between site feature. Area-specific sketches should be prepared as work is undertaken in such areas, and updated sketches should be drawn as work progresses.

Site Features

Examples of features to be noted on the site sketch include the following:

- Structures such as buildings or building debris;
- Drainage ditches or pathways, swales, and intermittent streams (include direction of overland runoff flow and direction of stream flow);
- Access roads, site boundaries, and utility locations;
- Decontamination and staging areas;
- Adjacent property data: the type of property that borders the site, information pertaining to ownership, and available addressees; and
- North arrow.

Changes in Site Conditions

Any deviation from previous site sketches or drawings presented in the work plan, and any changes that have occurred since the last site visit must be noted. Differences to be noted include the following:

- Demolished buildings;
- Changes to access routes;
- Damage to wells or equipment, or changes to the amount of such equipment believed to be on site,
- Changes resulting from vandalism;
- Destruction of reference points;
- Changes resulting from environmental events or natural disasters; and
- Locations of excavations, waste piles, investigation-derived waste (IDW), drum staging areas, etc.

In short, *any* site condition that varies from the conditions described in the work plan should be noted.

4.3 Monitoring Equipment and Activities

Any monitoring equipment used during field activities should be documented in the log-book. Information to be noted includes:

- The type of equipment with model and serial numbers. (HNu, OVA, etc.);
- The frequency at which monitoring is performed;
- Calibration results and the frequency at which the equipment is calibrated or tested;
- Background readings;
- Any elevated or unusual readings; and
- Any equipment malfunctions.

It is particularly important to note elevated or unusual equipment readings because they could have an impact on personal protection levels or the activities to be performed on site. If a

change in the proposed work or protection levels occurs, it should be clearly noted in the logbook.

4.4 Sample Collection Activities

Because it represents the first step in an accurate chain-of-custody procedure, field sampling documentation must be complete. The following items should be documented in the logbook:

Sample Collection Procedures

The following items pertaining to sample collection procedures should be included in the logbook:

- Any pre-sampling activities (i.e., well purging and the number of volumes purged before sample collection);
- Results of the pre-sampling activities (i.e., pH/conductivity/ temperature readings for well water, results of hazard categorization testing, etc.);
- Any environmental conditions that make sample collection difficult or impossible (i.e., dry or flooded drainage paths, inclement weather conditions, etc.); and
- Any deviation from the work plan (i.e., additional samples and the reason for their collection, alternate sample locations, etc.).

Sample Information

The following information regarding sample data should be recorded in the logbook:

- Sample number and station location including relationship to permanent reference point(s);
- Name(s) of sampler(s);
- Sample description and any field screening results;
- Sample matrix and number of aliquots if a composite sample;
- Preservatives used, recipient laboratory, and requested analyses;
- QA/QC samples; and
- Shipping paper (airbill) numbers, chain-of-custody form numbers, and jar lot numbers.

Investigation-Derived Waste/Sample Shipment

Details pertaining to sampling equipment, decontamination, and IDW should be clearly delineated in the work plan. However, the following information should be included in the log-book:

- The type of IDW generated an the number of containers generated (each drum should be numbered and its contents noted);
- All information relevant to the characterization of the IDW;
- Any directions received from the client/workplan/contract relative to the management of the IDW;
- The disposition of IDW (left on site or removed from site);
- The number of sample containers shipped to the ASC or laboratory and the courier used (i.e., Federal Express, Airborne Express, etc.);
- Airbill or shipment tracking numbers; and
- The type of paperwork that accompanied the waste/sample shipment (e.g., manifests, etc.).

4.5 Photodocumentation

Photographs should be taken during all relevant field activities to confirm the presence or absence of contaminants encountered during fieldwork. Specific items to be documented include:

- Sample locations and collection activities;
- Site areas that have been disturbed or impacted, and any evidence of such impacts (i.e., stressed vegetation, seepage, discolored water, or debris);
- Hazardous materials requiring disposal, including materials that may not appear in the work plan;
- Any evidence that attests to the presence or absence of contamination; and
- Any features that do not appear in the work plan or differ from those described in the work plan.

Documentation of any photographs taken during the course of the project must be provided in the logbook with a detailed description of what is shown in the photograph and the reason for taking it. This documentation should include:

- Make, model, and serial numbers of the camera and lens,
- Film type and number of exposures,
- Roll and frame number of the photograph;
- Direction or view angle of the photograph, and
- Name of the photographer.

4.6 Data Collection Forms

Certain phases of fieldwork may require the use of project-specific data collection forms, such as task data sheets or hazard categorization data sheets. Due to the specific nature of these forms, the information that should be included in the logbook cannot be fully discussed in this SOP. However, the following data should be included in the logbook:

- Results of any field tests or hazard categorization tests (i.e., ignitability, corrosivity, reactivity, etc.);
- The source from which any field sample was collected and its condition (i.e., drum, tank, lagoon, etc.).
- Other conclusions as a result of the data collected on data collection forms.

In many cases, rubber stamps that contain routine data collection forms can be manufactured ahead of time. These forms can be stamped into the logbook on an as-needed basis.

Appendix A

Sample Logbook

RI 6130

WEDNESDAY JANUARY 26, 1994

PROPOSED WORK FOR DAY: COLLECT GROUNDWATER SAMPLES FROM WELLS AND PIEZOMETERS AT SITE 1 AND SITE 3. SHIP SAMPLES TO THE ASC. CONTAINERIZE PURGE WATER. MEET WITH FRED CANSLER AND DISCUSS REMOVAL OF CANOPIES AT SITES 1 AND 3 AND FILLING OF EXCAVATIONS.

WEATHER ON SITE: CLOUDY AND WARM WITH A HIGH TEMPERATURE OF 50° F. RAIN SHOWERS WITH WINDS FROM THE SW AT 5-15 MPH.

E&E PERSONNEL ON SITE: G. JONES, J. MAHS, S. MCCOLL

LOG

1330 ARRIVED ON SITE. THE GROUNDWATER SAMPLING CREW WAS PREPARING TO PURGE THE WELLS AND PIEZOMETERS IN THE FIELD ACROSS THE ROAD FROM SITE 1. PURGING OF WELLS BEING COMPLETED WITH HAND BAILERS SINCE PUMP IS INOPERATIVE.

1340 ARRIVED AT SITE 3. MW3-1 AND MW3-3 UNLOCKED AND OPEN; SECURED BOTH WELLS.

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1350 FRED CANSLER ARRIVED ON SITE. DISCUSSED REMOVAL OF CANOPIES AND CLOSURE OF EXCAVATIONS AT SITES 1 AND 3. FRED CANSLER STATED THAT HE HAS A SOURCE FOR THE ROCK AND FOR THE TOPSOIL FOR THE EXCAVATIONS.

1405 ARRIVED AT THE SITE WHERE FRED CANSLER PROPOSES TO REMOVE THE FILL FOR THE EXCAVATIONS. A HILL ON THE WEST SIDE OF THE WOODEN NICKLE IS IN THE PROCESS OF BEING REMOVED. THE ROCK CONSISTS OF WEATHERED SHALE SIMILAR TO THE ROCK REMOVED FROM THE EXCAVATIONS. FRED CANSLER PROPOSES TO USE THE ROCK TO FILL THE EXCAVATIONS TO WITHIN ONE FOOT OF GRADE.

1415 ARRIVED AT THE SITE WHERE FRED CANSLER PROPOSES TO REMOVE TOP SOIL FOR THE EXCAVATIONS. TOP SOIL REMOVED FROM THE YELLOW FREIGHT LOT IS IN PILES ON THE NORTH SIDE OF THE LOT.

1430 RETURNED TO SITE 3. FRED CANSLER WILL ARRANGE TO REMOVE THE CANOPY OVER THE EXCAVATION AT SITE 3 ON THURSDAY MORNING AND WILL ARRANGE TO BRING THE ROCK IN ON THURSDAY AFTERNOON. TWO TRUCKS WILL BE USED TO HAUL THE FILL. THE SUPPORTS HOLDING THE CANOPY

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1430 (EST) WILL BE CUT AND THE CANOPY DRAGGED AWAY FROM THE EXCAVATION.

1445 CONTACTED JOY INMAN FROM ENVIRONICS. TANKERS WILL BE ON SITE ON THURSDAY TO PUMP OUT THE EXCAVATION AT SITE 3 AND ON FRIDAY TO REMOVE WATER AT SITE 1. A FRAC TANK WILL BE DELIVERED TO SITE 1 ON THURSDAY.

1515 SAMPLING CREW COMPLETED PACKING SAMPLES COLLECTED AT SITE 1. ALL WELLS AND PIEZOMETERS AT SITE 1 HAVE BEEN SAMPLED

1530 SAMPLING CREW COMPLETED PACKING SAMPLES AND SECURING DRUMS OF PURGE WATER.

1535 SAMPLING CREW DEPARTED SITE TO DELIVER SAMPLES TO FEDERAL EXPRESS.

1600 CONTACTED TIM GRADY FROM E+E. DISCUSSED CONVERSATION WITH FRED CANSLER AND STATUS OF WELL/PIEZOMETER SAMPLING.

1615 SECURED FOR DAY.

WORK COMPLETED: COLLECTED GROUNDWATER SAMPLES FROM SITE 1 WELLS AND PIEZOMETERS. DISCUSSED REMOVAL OF CANOPIES AND FILLING OF EXCAVATIONS WITH FRED CANSLER. SHIPPED SAMPLES TO ASC

1/26/94

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RI&I30

THURSDAY JANUARY 27, 1994

PROPOSED WORK FOR DAY: COMPLETE COLLECTION OF GROUNDWATER SAMPLES AT SITE 3 AND SHIP THE SAMPLES TO THE ASC. REMOVE THE CANOPIES COVERING THE EXCAVATIONS AT SITES 1 AND 3. PUMP THE WATER OUT OF THE EXCAVATIONS AT SITES 1 AND 3 AND SHIP THE WATER OFF SITE TO OSCO. BACKFILL THE EXCAVATION AT SITE 3. REMOVE THE DRUMS FROM THE ROLL OFF BOX AND TRANSFER THE DRUMS TO THE WAREHOUSE.

WEATHER ON SITE: CLOUDY AND COOL WITH A HIGH TEMPERATURE OF 45°F. WINDS VARIABLE 10-20 MPH.

E+E PERSONNEL ON SITE: A. JONES, J. MAYS, S. MCCUNE

LOG

0700 SCOTT MCCUNE ARRIVED AT SITE 3.

0710 ENVIRONICS PERSONNEL ARRIVED AT SITE 3.

0715 HELD SITE SAFETY MEETING. DISCUSSED PHYSICAL AND CHEMICAL HAZARDS ASSOCIATED WITH SITE AND PROPOSED WORK FOR THE DAY.

0725 E+E SAMPLING TEAM ARRIVED ON SITE

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0730 E+E Sampling Crew Commenced Collecting Samples and Purging MW3-1 and MW3-2.

0800 Frea Canseler arrived on site with personnel to remove the canopy over the excavation at Site 3. The supports were cut and the canopy was dragged away from the excavation with two tractors.

0845 The canopy removal at Site 3 completed and the crew departed for Site 1.

0850 Commenced pumping water from the excavation into Bryson Trailer #61BC's.

0915 The E+E Sampling Team completed collecting the groundwater samples from MW3-1, MW3-2, MW3-3, and MW3-4. Commenced packing samples.

0935 Completed filling Bryson Trailer #61BCS with 5,000 gallons of water and prepared manifest #00941 for load. Commenced loading Bryson Trailer #429.

1000 E+E Sampling Team departed the site to deliver samples to Federal Express.

1030 Arrived at Site 1. The Canseler crew is in the process of removing the canopy over the excavation. Canopy is not moving as a unit.

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1045 Returned to Site 3. All water in the excavation has been removed except for the ice. Bryson Trailer # 429 loaded with 5,200 gallons of water. Prepared manifest # 00942 for load. Both trailers departed the site.

1100 Environics personnel opened the drums of drilling fluids, development water and purge water and found the drums full of ice. Environics will contact Gary Shockley and recommend that the drums of liquids be transported to OSCO for treatment since they can not be bulked.

1200 Canseler crew commenced loading trucks with stone from the site west of the Wooden Nickel.

1230 Arrived at the site where the stone was being loaded. The fill material is all undisturbed weathered bedrock.

1245 Arrived at Site 3. Two loads of rock fill have been dumped in the excavation. An estimated four more loads of stone will be needed to fill the excavation.

1300 Arrived at Site 1. Bryson Trailer #617

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TITLE: FIELD ACTIVITY LOGBOOKS

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STANDARD OPERATING PROCEDURE

SAMPLE PACKAGING

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TITLE:	**SAMPLE PACKAGING**
CATEGORY:	ENV 3.16
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TITLE:	SAMPLE PACKAGING		
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1. Introduction

Liquid and solid environmental samples are routinely collected by E & E during field surveys, site investigations, and other site visits for laboratory analysis. Unless the samples have anesthetic, noxious, or other properties that could inhibit the ability of a flight crew member to perform his or her duty or are known to meet the established U.S. Department of Transportation criteria for hazardous material (i.e., explosive, corrosive, flammable, poisonous), they are not regulated as hazardous materials.

This Standard Operating Procedure (SOP) describes the packaging procedures to be used by E & E's staff to ensure the safe arrival of the samples at the laboratory for analyses. These procedures have been developed to reduce the risk of damage to the samples (i.e., breakage of the sample containers), promote the maintenance of sample temperature within the cooler, and prevent spillage of the sampled material should a container be broken.

In the event the sample material meets the established criteria of a DOT hazardous material, the reader is referred to E & E's Hazardous Materials/Dangerous Goods Shipping Guidance Manual (see H&S 5.5).

2. Scope

This SOP describes procedures for the packaging of environmental samples in:

- Coolers;
- Steel, aluminum and plastic drums; and
- 4GV fiberboard boxes.

The Hazardous Materials/Dangerous Goods Shipping Guidance Manual will complete the information needed for shipping samples by providing guidance on:

- Hazard determination for samples which meet the USDOT definition of a hazardous material;
- Shipping profiles for "standard" shipments;
- Shipping procedures for "non-standard" shipments;
- Marking of packages containing hazardous materials;
- Labeling of packages containing hazardous materials; and
- Preparation of shipping papers for hazardous materials shipment.

3. Sample Packaging Procedures

3.1 General

It is E & E's intent to package samples so securely that there is no chance of leakage during shipment. This is to prevent the loss of samples and the expenditure of funds for emergency responses to spills and the efforts necessary to re-obtain the sample.

Over the years, E & E has developed several "standard" package configurations for the shipping of environmental samples. These standard package configurations are described below.

Liquid samples are particularly vulnerable. Because transporters (carriers) do not know the difference between a package leaking distilled water and a package leaking a hazardous chemical, they will react to a spill in an emergency fashion, potentially causing enormous expense to E & E for the cleanup of the sample material. Therefore, liquids are to be packed in multiple layers of plastic bags and absorbent/cushioning material to preclude any possibility of leaks from a package. This section defines the standard packaging configurations for environmental samples.

3.2 Liquid Environmental Sample Packaging Procedures

Liquid environmental samples should be collected and preserved as outlined in the Standard Operating Procedures (SOP) for Surface Water Sampling (ENV 3.12), and Groundwater Well Sampling (ENV 3.7). ***Preserved water samples are not considered to meet the HM/DG definitions of Class 8 (Corrosive) due to the preservative and are therefore considered to be nonhazardous samples.*** Liquid environmental samples may be shipped using an 80-quart cooler or an outer package consisting of either a steel or aluminum drum. Because the steel and aluminum drums provide little insulating capability, they should not be used for samples that require icing.

Packaging Liquid Environmental Samples Using the 80-Quart Cooler

- Label and seal all water sample bottles according to appropriate sampling SOPs;
- Secure the bottle caps using fiberglass tape; and
- Place each amber, poly, and volatile organic analysis (VOA) bottle in a sealable plastic bag. Mark the temperature blank VOA bag for identification.

If a foam block insert is used:

- Line the cooler with two plastic bags;
- Place a foam insert (with holes cut to receive the sample bottles) inside the plastic bag;

- Place the bottles in the holes in the foam block;
- Fill void spaces with bagged ice to the top of the cooler;
- Fold over the plastic bags lining the cooler and secure shut with tape;
- Place Chain-of-Custody (C-O-C) form in a sealable bag and tape it to the inside of the cooler lid; and
- Secure the cooler with strapping tape and custody seal. Cover the custody seals with clear tape.

If acceptable absorbent material is used:

- Place 1 inch of inert absorbent material in the bottom of the cooler;
- Line the cooler with two plastic bags;
- Place each sample bottle inside the inner bag;
- Fill the void spaces around the bottles with absorbent to about half the height of the large bottles;
- Fill the remainder of the void spaces with bagged ice to within 4 inches of the top of the cooler, making sure the VOAs are in direct contact with a bag of ice;
- Fold over the plastic bags lining the cooler and secure shut with tape;
- Fill the remaining space in the cooler with absorbent to the top of the cooler;
- Place C-O-C form in a sealable bag and tape it to the inside of the cooler lid; and
- Secure the cooler with strapping tape and custody seal. Cover the custody seals with clear tape.

Note: Acceptable absorbent materials must not react dangerously with the liquid and include vermiculite only if certified asbestos free.

Alternate Packaging Using 1A2/1B2 Drum

- Place 3 inches of inert absorbent material in the bottom of the drum;
- Line the drum with two plastic bags;
- Place each sample bottle inside the inner bag;

- Fill the void spaces around the bottles with absorbent to the height of the larger bottles;
- Fold over the plastic bags lining the drum and secure shut with tape;
- Fill the remaining space in the drum with absorbent to the top of the drum;
- Place C-O-C form in a sealable bag and tape it to the inside of the drum lid; and
- Secure the drum with closing ring and apply custody seals. Cover the custody seals with clear tape.

3.3 Soil/Sediment Environmental Sample Packaging Procedures

Soil/sediment environmental samples should be collected as outlined in the SOP for Soil Sampling (ENV 3.13), and SOP for Sediment Sampling (ENV 3.8). Soil/sediment environmental samples may be shipped using an 80-quart cooler, a 4GV fiberboard combination package, or an outer package consisting of either a steel or aluminum drum. Because the steel and aluminum drums provide little insulating capability, they should not be used for samples that require icing.

Packaging Soil/Sediment Environmental Samples

- Label and seal each sample container according to SOPs;
- Secure the bottle caps using fiberglass tape;
- Place each sample bottle inside a sealable plastic bag and place it in its original shipping box or in individual fiberboard boxes. Mark the temperature blank bag for identification; and
- Secure the original shipping box with strapping tape, place shipping box in a plastic bag, and secure the plastic bag with tape.

If an 80-quart cooler is used:

- Place bubble pack or similar material on the bottom and sides of an 80-quart cooler;
- Place the bagged shipping boxes in the cooler with a layer of bubble pack between each box;
- Fill the void spaces with “blue ice” or ice in baggies to the top of the cooler;
- Place C-O-C form in a sealable baggie and tape it to the inside of the cooler lid; and

- Secure the cooler with strapping tape and custody seal. Cover the seals with clear tape.

If a 1A2/1B2 drum is used:

- Place 3 inches of inert absorbent material in the bottom of the drum;
- Line the drum with two plastic garbage bags;
- Place the boxes inside the inner bag;
- Fill the space around the samples with absorbent;
- Fold over the plastic bags lining the drum and secure shut with tape;
- Fill the remaining space around the bags with absorbent to the top of the drum;
- Place C-O-C form in a sealable bag and tape it to the inside of the drum lid; and
- Secure the drum with the closing ring and apply custody seals. Cover the custody seals with clear tape.

Note: If a small number of samples are being shipped, it may be more practical to package them using the absorbent or foam block configurations used for shipping liquid samples.

4. Shipping Procedures

Environmental samples are to be shipped as nonhazardous cargo. Unless the samples have anesthetic, noxious, or other properties that could inhibit the ability of a flight crew member to perform his or her duty or are known to meet the established U.S. Department of Transportation criteria for a hazardous material (i.e., explosive, corrosive, flammable, poisonous), they are not regulated as hazardous materials. When preparing the containers (i.e., cooler, drum, or box) for shipment, E & E staff must remove all labels from the outside container. Labels indicating that the contents may be hazardous are misleading and are not appropriate. Markings indicating ownership of the container, destination, and chain of custody labels are acceptable and can be attached as required.

When completing the paperwork for shipment, the standard nonhazardous forms must be used. Do not use the hazardous materials/dangerous goods airbills, either in total or in part; these forms are coded and their use will invite unnecessary questions. This will only serve to confuse DHL or Federal Express' terminal personnel and will cause much frustration and the delay of sample shipment.

Environmental sample packages can be shipped overnight by both DHL and Federal Express. When choosing between the two, cost should be considered. It is normally much cheaper

to ship DHL. In addition, DHL tends to have remote locations open later in the evenings than Federal Express, which may be helpful when trying to complete a full day's sampling effort and still make the flights on time. Although both companies offer pickup of samples at the site, it is advisable to call ahead and ensure that this service is offered beforehand. In almost all cases, both companies will deliver to the laboratory of your choice on Saturdays. When planning for sampling activities, check with the companies in advance to verify pick-up and delivery schedules.

Title:	**SURFACE WATER SAMPLING**
Category:	ENV 3.12
Revised:	March 1998

STANDARD OPERATING PROCEDURE

SURFACE WATER SAMPLING

ecology and environment, inc.
368 Pleasant View Drive / Lancaster, New York 14086 / (716) 684-8060

TITLE:	**SURFACE WATER SAMPLING**
CATEGORY:	ENV 3.12
REVISED:	March 1998

TABLE OF CONTENTS

TITLE:	SURFACE WATER SAMPLING		
CATEGORY:	ENV 3.12	REVISED:	March 1998

1. Introduction

This Standard Operating Procedure (SOP) outlines recommended procedures and equipment for the collection of representative liquid samples (aqueous and nonaqueous) from streams, rivers, lakes, ponds, lagoons, and surface impoundments both at the surface and at various depths in the water column. This SOP does not pertain to the collection of groundwater samples.

2. Method Summary

Sampling situations vary widely and therefore, no universal sampling procedure can be recommended. A sampling plan must be completed before any sampling operation is attempted. The sampling plan should include objectives of the study, the number and type of samples required to meet these objectives, and procedures to collect these samples based on site characteristics.

The sampling of both aqueous and nonaqueous liquids from the above-mentioned sources is generally accomplished through the use of one of the following:

- Kemmerer bottle,
- Bacon bomb,
- Dip sampler, or
- Direct method.

These sampling techniques will allow for the collection of representative samples from the majority of surface water types and impoundments encountered.

3. Potential Problems

There are two primary potential problems associated with surface water sampling: cross-contamination of samples, and improper sample collection.

Cross-contamination problems can be eliminated or minimized through the use of dedicated sampling equipment and bottles. If this is not possible or practical, then decontamination of sampling equipment is necessary. See E & E's SOP on *Equipment Decontamination* (ENV 3.15).

Improper sample collection can involve using contaminated equipment, disturbance of stream or impoundment substrate, and sampling in a disturbed area such as that caused by a boat wake. Following proper decontamination procedures and minimizing disturbance of the sample site will minimize or eliminate these problems.

4. Equipment

Equipment needed for collecting surface water samples includes:

- Kemmerer bottle,
- Bacon bomb,
- Dip sampler,
- Line and messengers,
- Sample bottles, preservative, ziploc bags, ice, coolers,
- Chain-of-custody seals and forms, field data sheets,
- Decontamination equipment,
- Protective clothing,
- Maps/plot plan,
- Safety equipment,
- Compass,
- Tape measure,
- Survey stakes, flags, or buoys and anchors,
- Camera and film,
- Logbook, and
- Sample bottle labels.

5. Reagents

Reagents are commonly used to preserve samples and to decontaminate sampling equipment. Appropriate preservation and decontamination procedures should be selected prior to field sampling.

Preservatives commonly used include:

- Nitric acid (HNO_3) for metals analyses,
- Sodium hydroxide (NaOH) for cyanide analysis,
- Sulfuric acid (H_2SO_4) for TRPH analysis, and
- Hydrochloric acid (HCl) for VOC analysis.

Decontamination reagents include:

- Nitric acid (HNO_3),
- Acetone, and
- Deionized or distilled water.

6. Health and Safety

Personal safety is always the most important factor in any sampling operation. Sampling under unknown conditions should always be considered worst case, necessitating the selection of appropriate personal protection.

When sampling lagoons or surface impoundments containing known or suspected hazardous substances, adequate precautions must be taken to ensure the safety of sampling personnel. The sampling team member collecting the sample should not get too close to the edge of the impoundment, where bank failure may cause him/her to lose their balance. The person performing the sampling should be on a lifeline and wearing adequate protective equipment.

When conducting sampling from a boat in an impoundment or flowing waters, appropriate boating safety procedures will be followed.

7. Procedures

7.1 Sampling Considerations

7.1.1 Preparation

Prior to the initiation of any sampling operation, the immediate area should be checked for radioactivity, volatile organic compounds (VOCs), photoionization potential, airborne dust, and explosivity, as required by the Site Safety Plan. The following steps should then be taken:

- Determine the extent of the sampling effort, the sampling methods to be employed, and the equipment and supplies needed;

- Obtain necessary sampling and monitoring equipment;
- Decontaminate or preclean equipment, and ensure that it is in working order;
- Prepare scheduling and coordinate with staff, clients, and regulatory agency, if appropriate; and
- Use stakes, flags, or buoys and anchors to identify and mark all sampling locations. If required, the proposed locations may be adjusted based on site access, property boundaries, and surface obstructions.

7.1.2 Representative Samples

In order to collect a representative sample, the hydrology and morphology of a stream or impoundment should be determined prior to sampling. This will aid in determining the presence of phases or layers in lagoons or impoundments, flow patterns in streams, and appropriate sample locations and depths. Additional information can be found in the references listed in Section 12.

Generally, the deciding factors in the selection of a sampling device for surface water sampling are:

- The depth and flow of surface water body,
- Location from where the sample will be collected, and
- The depth at which the sample(s) is to be collected.

7.1.3 Sampler Composition

The sampling device must be constructed of the appropriate materials. Samplers constructed of glass, stainless steel, PVC, or PFTE (teflon) should be used, depending on the types of analyses to be performed (i.e., samples to be analyzed for metals should not be collected in metallic containers).

7.2 Sample Collection

7.2.1 Kemmerer Bottle

A Kemmerer bottle may be used in most situations where site access is from a boat or structure such as a bridge or pier, and where samples at depth are required. Sampling procedures are as follows:

- Using a properly decontaminated Kemmerer bottle, set the sampling device so that the sampling end pieces are pulled away from the sampling tube, allowing the substance to pass through this tube;

- Slowly lower the preset sampling device to the predetermined depth. Avoid bottom disturbance;

- When the Kemmerer bottle is at the required depth, send down the messenger, closing the sampling device; and

- Retrieve the sampler. Transfer sample to sample container.

7.2.2 Bacon Bomb

This type of sampler may be used in situations similar to those outlined for the Kemmerer bottle. Sampling procedures are as follows:

- Lower the bacon bomb sampler carefully to the desired depth, allowing the line for the trigger to remain slack at all times. When the desired depth is reached, pull the trigger line until taut; and

- Release the trigger line and retrieve the sampler. Transfer the sample to the sample container by pulling on the trigger.

7.2.3 Dip Sampler

A dip sampler is useful for situations in which a sample is to be recovered from an outfall pipe, such as through a storm sewer grating, or along a lagoon bank where direct accessibility is limited. The long handle on such a device allows access from a discrete location. The procedure is as follows:

- Assemble the device in accordance with the manufacturer's instructions,

- Extend the device to the sample location and collect the sample, and

- Retrieve the sampler.

7.2.4 Direct Method

For streams, rivers, lakes, and other surface waters, the direct method may be utilized to collect water samples from the surface. This method is not to be used for sampling lagoons or other impoundments where contact with contaminants is a concern.

Using adequate protective clothing (i.e., gloves and hip waders), access the sampling station by appropriate means (wading or boat). For shallow stream stations, collect the sample under the water surface pointing the sample container upstream. The container must also be up-

stream of the collector. Avoid disturbing the substrate. For lakes and other impoundments, collect the sample under the water surface avoiding surface debris and the boat wake.

8. Sample Preservation, Containers, Handling, and Storage

Sample preservation, sample containers, sample handling, and sample storage are critical concerns for many types of analyses. Once the analyses to be performed are determined, E & E's SOP on sample packaging and shipping should be consulted to determine the above parameters. This must be completed prior to field sampling.

Once the samples have been collected, the following procedure should be followed:

- Transfer the sample(s) into suitable and labeled sample containers;
- Preserve the sample, if appropriate;
- Cap and put a custody seal on the container, package appropriately, and place in an iced cooler if required;
- Record all pertinent data in the field logbook and on a field data sheet;
- Complete chain-of-custody record and sample analysis request form;
- Attach custody seals to cooler prior to shipment; and
- Decontaminate all sampling equipment prior to the collection of additional samples.

9. Calculations

This procedure does not involve specific calculations.

10. Quality Assurance

There are no specific quality assurance (QA) activities that apply to the implementation of these procedures. However, the following general QA procedures apply:

- All data must be documented on field data sheets or within field or site logbooks;
- All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer unless otherwise specified in the work plan. Equipment

checkout and calibration activities must occur prior to sampling or operation and must be documented; and

- All deliverables will receive a peer review prior to release.

11. Data Validation

The data generated will be reviewed according to the QA considerations listed in Section 9.

12. References

U.S. Environmental Protection Agency, 1991, *Compendium of ERT Surface Water and Sediment Sampling Procedures*, Interim Final, OSWER Directive 9360.4-03.

_____, 1984, *Characterization of Hazardous Waste Sites - A Methods Manual: Volume II, Available Sampling Methods*, (2nd ed.), EPA/600/4-84-076.

U.S. Geological Survey, 1977, *National Handbook on Recommended Methods for Water Data Acquisition, Office of Water Data Coordination, Reston, Virginia*.

B Sample Plan Alteration Form

SAMPLE PLAN ALTERATION FORM

Project Name and Number:

Material to be Sampled:

Measurement Parameters:

Standard Procedure for Field Collection and Laboratory Analysis (cite references):

Reason for Change in Field Procedure or Analytical Variation:

Variation from Field or Analytical Procedure:

Special Equipment, Materials, or Personnel Required:

CONTACT	APPROVED SIGNATURE	DATE
Initiator:		
START PL:		
EPA TM:		
EPA QA Manager :		

C Sample Documents

CUSTODY SEAL

Date:
Signature:

USEPA Contract Laboratory Program
Inorganic Traffic Report & Chain of Custody Record

1. Case No.:	R
DAS No.:	

2. Region:	3. Date Shipped:	4. Chain of Custody Record	Sampler Signature:
Project Code:	Carrier Name:	Relinquished By: (Date/Time)	Received By: (Date/Time)
Account Code:	Airbill:	1)	
CERCLIS ID:	Shipped To:	2)	
Spill ID:		3)	
Site Name/State:		4)	
Project Leader:			
Action:			
Sampling Co.:			

5. INORGANIC SAMPLE No.	6. MATRIX/ SAMPLER	7. TYPE	8. ANALYSIS/ TURNAROUND	9. TAG No./ PRESERVATIVE/Bottles	10. STATION LOCATION	11. SAMPLE COLLECT DATE/TIME	12. ORGANIC SAMPLE No.	13. QC Type

14. Shipment for Case Complete?	15. Sample(s) to be used for laboratory QC:	16. Additional Sampler Signature(s):	17. Chain of Custody Seal Number:
18. Analysis Key:	**Type:** Comp, Grab (from Box 7)		19. Shipment Iced? _____

20. TR Number:

PR provides preliminary results. Requests for preliminary results will increase analytical costs.

Send Copy to: Sample Management Office, 2000 Edmund Halley Dr., Reston, VA 20191-3400 Phone 703/264-9348 Fax 703/264-9222

REGION COPY

10/02

USEPA Contract Laboratory Program
Organic Traffic Report & Chain of Custody Record

1. Case No.:	R
DAS No.:	

2. Region:	3. Date Shipped:	4. Chain of Custody Record	Sampler Signature:
Project Code:	Carrier Name:	Relinquished By: (Date/Time)	Received By: (Date/Time)
Account Code:	Airbill:	1)	
CERCLIS ID:	Shipped To:	2)	
Spill ID:		3)	
Site Name/State:		4)	
Project Leader:			
Action:			
Sampling Co.:			

5. ORGANIC SAMPLE No.	6. MATRIX/ SAMPLER	7. TYPE	8. ANALYSIS/ TURNAROUND	9. TAG No./ PRESERVATIVE/Bottles	10. STATION LOCATION	11. SAMPLE COLLECT DATE/TIME	12. INORGANIC SAMPLE No.	13. QC Type

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